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American Machinist

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Volume 70 | New York, May 9, 1929 | Number 19

Finishing Operations
on Aluminum Furniture

To produce a high-grade wearing finish the metal is carefully surfaced and all coats of enamel are baked

ALUMINUM furniture manufacture, although a comparatively recent industry, has developed from the first on a production basis to meet the demands for a large number of models and types in various finishes. Aluminum furniture has a weight only about half of that of wooden furniture, and it has the further advantages of being fireproof and capable of withstanding severe racking abuse. Chairs made of this metal are employed extensively in hotels, restaurants, offices, and on dining cars.

The metal chairs fabricated at the Buffalo plant of the Aluminum Company of America are made from a strong aluminum alloy containing approximately 98 per cent of aluminum and 2 per cent of magnesium and silicon. This alloy, after fabricating from the heat-treated condition, is capable of physical improvement by aging, and as the temperatures and time required for this purpose are approximately the same as those required for baking the enamels used in finishing, these operations may be considered as combined. The heat-treated alloy has a tensile strength corresponding favorably with that of mild steel, and is very rust-resistant.

Aluminum furniture may be finished in any color, but it is usually limited to imitation walnut and mahogany graining, dark green or maroon for office use, and the natural aluminum color. All of the finishes applied to aluminum furniture are baked, a point which is obviously not possible with finishes for wooden furniture because of warpage or destruction of the wood. Owing to their high decomposition points, therefore, these baked-enamel finishes will not blister easily, and are also tough enough to withstand severe abrasion.

The first operation in finishing is grinding off the excess metal of the welds and smoothing the fillets. This is done, as in Fig. 1, with a rotating disk faced with fine abrasive cloth. The operation is accomplished by hand with a flexible-shaft drive for the disk. The welds are then further polished down with fine Carborundum cloth as shown in Fig. 2. When this grinding and polishing is completed the chairs are practically a one-piece job with continuous smooth surfaces.

The foundation that is considered the best for firm

Fig. 1 — Grinding off the surplus metal from the welds. Fig. 2 — Hand polishing the ground welds with abrasive cloth

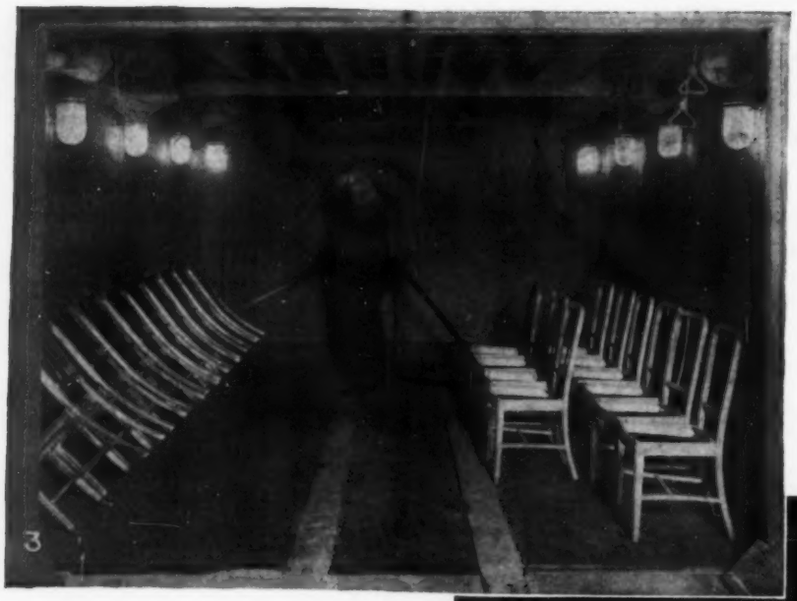


Fig. 3 — Sandblast chamber for preparing the surface of the aluminum for the primer coat. The fine sand gives a "toothed" surface which holds the primer

Fig. 4 — The baking ovens are kept at a uniform temperature. Besides baking the enamel the heat also serves to "age" the aluminum alloy

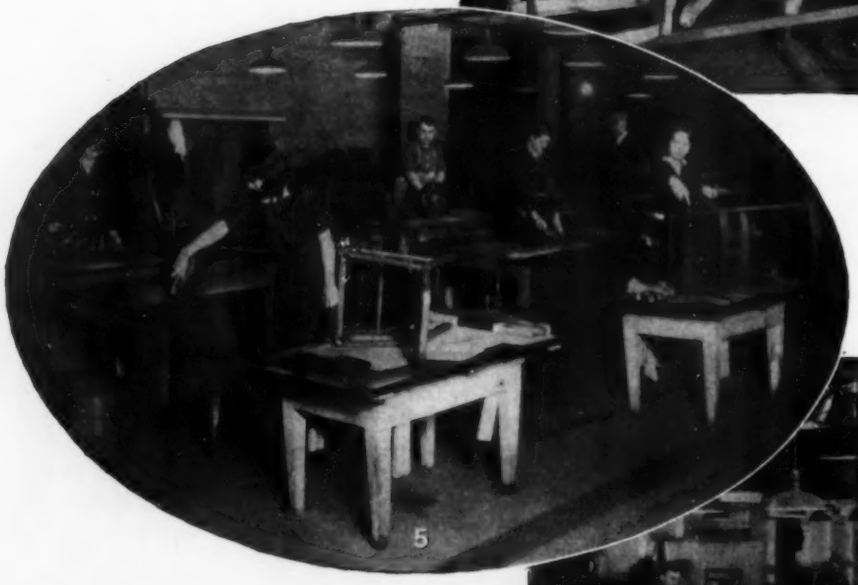


Fig. 5 — Graining the chair frames in imitation of various woods. The black enamel is transferred from engraved copper plates by means of printers' rolls

Fig. 6 — Rubbing down the final varnish coat with rottenstone and oil to produce a satin finish

adherence of the enamel is a sand-blasted surface which gives a "toothed" effect and holds the base coat of enamel. In Fig. 3 is shown a sand-blasting chamber. An air pressure of 25 lb. per sq.in. is employed instead of the usual high pressure, which would cut the soft metal. After sand-blasting, the chairs or other articles are not touched with bare hands, but are handled with clean cotton gloves to avoid making grease spots under the finish.

Primer coats are baked black or nearly so. They contain tung oil, varnish vehicle, and either iron oxide or burnt umber to give the color. The primer coat is sprayed onto the metal to give a fairly heavy coat. The spraying is done in standard spraying booths with air guns. The baking is done for 2½ hours in an oven maintained at approximately 325 deg. F. by electric thermostatic control and fan agitators. The chairs are placed on cars, as in Fig. 4, and pushed in and out of the ovens. After baking, the primer coat is sandpapered lightly, and two ground coats of color enamel are then sprayed on, each being baked for 2½ hours under the same conditions as for the primer.

Graining, in imitation of wood, is done with printers' rolls, as in Fig. 5. The black varnish is spread over a copper plate upon which the reproduction of the wood has been etched, and the grain is then transferred to the chair by means of the rollers. When the grain pattern has been imprinted upon the ground color, it is baked at a temperature of 150 deg. F. for a period of 3 to 4 hours for setting, after which the metal is varnished. A baking varnish is employed, and three coats are applied, being baked for 2½ hours at approximately 225 deg. F. The last coat of varnish is rubbed down with rottenstone and oil as shown in Fig. 6, in order to produce a satin finish. When plain colors are used instead of graining, one or two coats of enamel are substituted for the three varnish coats, and a harder and tougher finish is obtained. When the natural aluminum color is desired only, special baked varnish coats are applied.

Most types of aluminum chairs are fitted with leather upholstered seats, back cushions, and arm pads. The operation of attaching these is illustrated in Fig. 7. The parts are fastened to the metal with concealed screws, so that they can be removed readily if desired for refinishing.

As the enamels and varnishes used in finishing are procured on the open market from manufacturers of these products, the machine test shown in Fig. 8 was devised for comparative testing of the finished surfaces.

Fig. 7 — Attaching the leather cushions and arm pads of the chairs with concealed screws

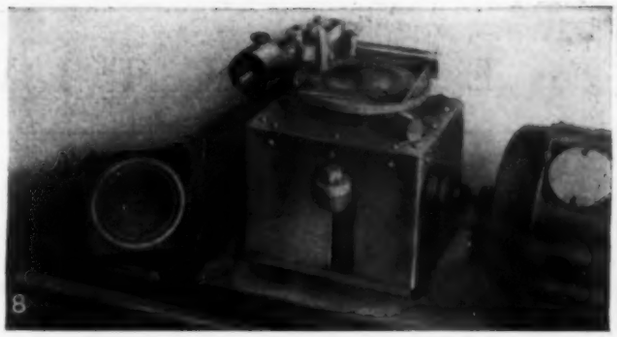


Fig. 8 — Machine used for comparative testing of the finishes used on aluminum furniture

The specimen plates for test are finished under the same conditions as required for the furniture. They are arranged for test on the revolving table of the testing machine which is driven by a motor at 30 r.p.m. Resting upon the enameled test plate is a weighted abrading disk 1⅜ in. in diameter made of standard ink-eraser rubber composition. This disk is free to revolve, but is placed on an angle to cause abrasion. The number of revolutions of the table is recorded by a revolution counter, and accurate comparisons of abrasion wear can be made. In addition to this test the finish is also subjected to tests for chipping, scratching, bending and to the action of heat and chemical solvents.

Lighting for 24-Hour Production

IT IS a recognized fact, but one too often lost sight of that it pays to keep machines producing 24 hours per day, since interest and depreciation charges continue to accumulate whether production machines are running or idle, writes Herbert Chase, in the April issue of the S. A. E. *Journal*. This fact is not overlooked in the Ford plants. It is characteristic of this organization, as of many other progressive concerns, that such variables as weather or time of day do not interfere with production. Daylight, for example, though employed when available and where its use fits in with the production program, is not necessarily a primary consideration.

Ford buildings are designed to conform to production requirements and provision is then made to assure adequate and good-seeing light without regard to weather, season, or time of day. The perfection of modern lighting-systems has made this policy possible and highly successful. For the same reason multiple-story structures are used in place of the saw-tooth-roof type of building once supposed to bring ideal lighting conditions.

Light can now be produced artificially that provides even better illumination than daylight. Mr. Chase refers to light composed chiefly of green and yellow rays which are highest in visual value, and which, because of their relatively low energy content as compared with red rays so prominent in daylight, are easiest on the eyes. The Ford Company is one of the oldest and largest users of mercury vapor light in which green and yellow rays predominate.

Cylinder finishing is perhaps one of the best examples of the way in which a new process can supplant one that had previously been considered as standard. The hone, or grinding head, has replaced the grinding wheel on this work in almost every motor building plant.

Hiring Men From Other Shops

"I WANT to play the game, Mr. Holland, and I haven't any notion of interfering with another man's business, but I don't just like this business men's agreement about hiring men from other plants." It was Frank Warner, head of the Washing Machine Company, who had called on our counseller-at-large, Bill Holland, for advice—or experience.

"Just what's on your mind, Frank?" asked Bill.

"The particular case is that I need a good man to grow up as assistant manager, perhaps even more if he makes good. The most likely prospect is young Benton who works for the Harvester people. I asked the manager if he'd mind letting Benton come to me and he balked like a mule. Said they needed good men too, and hinted that I was a sort of pirate to think of hiring him.

"I can give Benton a better opportunity than the Harvester people ever can. Not because they are not a larger concern than ours, but there's two sons of the old man's coming along and it's only natural that they get the chance to work into the best jobs. They're wise boys too, and they ought to make good. But it's tough on Benton, and it keeps me from getting a good man. I'm not so sure these business agreements are good for the town, Mr. Holland."

"You've brought up a delicate subject, Frank, and one that frequently causes all kinds of grief. I'm inclined to agree that it doesn't help a town—or the men in it—as much as the plan was intended."

"Just what started the plan, Mr. Holland? I'm told most towns have some sort of an agreement like that."

"It does seem to be a sort of habit, Frank. It started, as I recall, after some shops got the notion that it didn't pay to train apprentices, and began offering more money to mechanics in other shops. 'Stealing men' was a favorite pastime during rush times, and so manufacturers sort of called a truce and agreed not to hire a man who was working in another shop."

"Doesn't seem quite fair on the men, Mr. Holland. Puts them in the ball player class without the high salary. If I were in the shop I'd like to feel free to get a job in the plant I liked the best. Prevents a man taking a better job if his boss is mean enough not to let him go."

"It doesn't always work out so well, Frank. One friend of mine kicked over the traces at a business meeting and told the rest of them that he'd hire anyone he pleased, and they could do the same.

" 'If I've got a man who is worth more to you than he is to me,' said he, 'it's a dog-in-the-manger trick to hold on to him. And if you just tell him to quit me before he asks you definitely for a job, no rules have been broken and I can't kick even though I know it's a trick to get him.' "

"And what came of it, Mr. Holland?"

"Well, the plan sort of died out and no one ever knew the difference that I could see. The men who wouldn't play fair without the agreement always found some way of breaking the rules and having and alibi, as they always do. I'm inclined to believe they get on fully as well as they did with the agreement, and the men seem more contented then under the old ruling.

"No real manager will do anything to embarrass his neighbor such as hiring away without making them give due notice. He will not offer more wages than the man is worth just to cripple a competitor. And I never could see why a man in the shop shouldn't have the chance to change jobs without going through the motions of quitting and losing time between jobs."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Rules—and When to Break Them

Rules are necessary in any organization. However, there is the danger, as in the case cited, that the rule may be adhered to too strictly. Because it fits the majority of cases, the manager may be inclined not to break it, even under exceptional circumstances.

Executives save themselves the trouble of

making countless petty decisions by the use of rules for routine work and company policies. But rules cannot be made to cover all cases. When they are made, it should be realized that special cases will arise where they will have to be violated.

When questions come up which are covered definitely by the ruling, these should not be brought to the attention of any executive. However, when special questions arise where the best results can be secured by breaking the rule, the decision should be referred to someone qualified to make the exception and render the decision.

—W. L. ROMICK.

I fully agree with Bill Holland's attitude toward rules, but I would make one very important distinction. Any rule which is purely internal to the organization should be willingly broken by an executive when, in his judgment, the circumstances warrant it. If rules were to be inflexible, all business enterprises, as far as internal administration is concerned, would soon reach a dead level of mediocrity, and some firms die of dry rot on this account.

But in contacts with outside concerns, where there is always the possibilty of a charge of favoritism, great caution must be exercised, and the tendency to break rules curbed as much as is practical. You may feel justified in pleasing a particular individual or concern by suspending a rule in his favor, but what about all the others who feel that they are entitled to the same privilege? The good will created on the one hand may be far outweighed by the ill feeling engendered on the other. Even at best, the way is open to a lot of argument over the merits of the exception. —IRVING W. FLIERL.

Is the Shop the "Goat?"

As a foreman for many years, it has been my experience to have attempts made to saddle my shop with extra cost, or to make the shop the "goat," when the fault has been in the office, where the selling price in many cases was all but eaten up. Many times I have seen big jobs, on which a definite price was quoted and delivery promised on a certain date, leisurely put through the office. Then the job has been handed to the shop, and it has been a case of working overtime, and at times all night, to get the work done on schedule.

Without presuming that we, as foremen, are without fault, I believe that, where it is possible for us to save cents, it is easily possible for the management and the district office staffs, if composed of the right people, to save dollars. The following suggestions to the management may help: Let the foremen be well paid; recognize merit and raise the men accordingly; supply information to the shops well in time; order materials far enough in advance; have tools and jigs ready when the work is due to go on the machines; then, having given a date for delivery, see that it is lived up to. Get the job completed and out of sight of the foremen and workmen at the earliest possible moment.

—T. J. SONTOW, *England.*

There are ample opportunities for large savings in departments other than the shop itself. Many such opportunities exist in the engineering department. But under prevailing systems of accounting, which usually charge off all engineering costs as overhead, my proposal would look as though costs were being increased rather than decreased.

More effort in studying the applications of new materials, processes and finishes, would greatly repay any organization, with a large saving in ultimate costs. But such work means more engineering overhead, and as there is no prevailing system which provides the means of evaluating a saving originating in the engineering department, it would be bitterly opposed, in many a company, as adding to costs. Hence, the chief engineer stands pat on his organization, or reduces it, although he knows he could save money in the end by expanding his force, if someone would only provide a score-keeping system to measure the results.

The sales organization could also contribute to savings by reducing selling costs. Most salesmen are inclined to regard expense items which are logical under certain conditions, as essential under all conditions. If they are questioned on these points they become indignant. Foremen get quizzed on the smallest item of cost, why not the salesmen as well?

Salesmen also show lack of judgment, in many cases, in entertaining. The man they really want to sell is often too busy to waste a whole evening on a combined business and social engagement. Perhaps he might enjoy a modest lunch with a little business conversation thrown in, or he may even prefer a direct fifteen-minute to-the-point business discussion. An expensive meal at a high-priced hotel is often a waste of time and money. —EDWARD J. FERGUSON.

Getting Details on Overhead Costs

In spite of the advent of motor drives, belting is still extensively used, and in some plants is a large item of cost. Where it is not possible to assign one man exclusively to look after belts, so that the full responsibility for the work can be fixed and the man in charge will have ample time to do his work thoroughly and well, it is advisable to have a consulting engineer, or a service man from one of the belting companies, come in once a month to look over the belts in the plant. Due to his extensive knowledge, and his experience in

many other plants, he is in a better position to give reliable advice than a man to whom the company has assigned the duty of looking after maintenance work in general.

Belt record forms are successfully used in a large number of manufacturing plants, and, in connection with an adequate inspection and maintenance system, provide the basis for most efficient service from the belts. The original date of installation of each belt on each machine is noted on the cards, together with all repairs made on the belts, and the date and cost of such repairs. Records of this type indicate where the most trouble is being experienced with belting, and enable the maintenance department to institute measures to correct the difficulty. The trouble often lies not in the belt itself, but in the way machines are used. Occasionally, also, belt drive is not suitable for the service in question, and either motor or chain drive should be substituted to gain the best result. —HARRY KAUFMAN.

Day Work or Piecework?

An experience of over fifty years as apprentice, mechanic and foreman, has convinced me that the difference between the amount of work a man turns out on a day-work plan, and the amount he is able to, and does, turn out under a straight piecework system is remarkable. Frequently, during over forty years of foremanship in mixed shops, I have given work out to men, with its price, and have been met with the objection, "The price is too low." Yet, with a little discussion, and a promise that the price would not be cut however high the amount earned, the men have tackled the tasks and made good. Hundreds of cases have arisen where men with a piecework incentive have surprised even themselves.

However, the question of whether day work or piecework is the better is by no means settled. The success of both methods of wage payment depends largely upon the tactful manner in which the plan is introduced, the honesty of the management, the ability of the foreman as a manager, and the full co-operation of both foreman and price-setters in the plan. Without the closest supervision on the part of the foreman, neither a day work plan nor a piecework plan has any chance of success as a trustworthy method of payment. In the absence of such supervision, either men are overworked, or the employer pays a rate too high to be earned honestly by his workers. —J. T. TOWLSON, *England*.

There is little doubt that more work can be accomplished under the piecework plan than under the day-work plan. Of course, it is not an easy task to introduce piecework in a shop when the men get up in arms at the mere suggestion.

In a plant where I was employed, I made the proposal that we install a piecework system as a substitute for the day-work plan then in service. The more I thought about the question, the more I became convinced that the change could be successfully accomplished. After using a stop watch on several jobs to check up on my time estimates, I decided to make the installation.

I selected one of the workmen and said to him, "Bill, how would you like to tackle this job at a piece price of so much, if I guarantee your hourly rate, provided you cannot make it?" After a little discussion as to the method, he agreed to try it. Much to his surprise, he made about 25 per cent over his day rate, and the amusing part of the situation was that he wanted to collect the premium as soon as the job was finished. With the first wedge driven, it was not hard to get the whole shop in line, especially after the first man received his premium on pay day. In fact, so many men wanted to work under piecework that it was necessary for me to take drawings home and sit up half the night figuring prices.

In the plant above mentioned, we have also tried the plan of letting the men set their own piecework prices. We could not do this with all men, of course, because no shop has workers all of whom are qualified to live up to such responsibilities. However, the plan worked well in our company and indicated to us those men who were interested in their work, and those who were concerned mainly with the arrival of quitting time and pay day. We have also had men ask us to cut a piece price because they believed it was too high, and therefore unjust to the company. This experience is not at all unusual. —C. G. FAUST.

For any particular set of workshop conditions there is probably one best system of wage payment, but there is no one best system to suit all conditions. The speed and feed of many of the more complicated up-to-date machines, and the methods of loading and unloading their fixtures, may be set so that the operator has, in fact, very little control over the operating time per piece. The standard rate of output is thus determined by the speed and feed selected by the time-study men, and the standard of quality by the inspection department. The operator is paid at a rate which depends on the prosperity of the business and the generosity of the executives.

A majority of workshops turn out a wide range of products which cannot be economically routed on a permanent conveyor system. The work has to be put through in lots, and done on standard machines with standard set-ups, according to carefully worked out schedules. Under these circumstances, the only alternative to some kind of piecework or bonus system is to set a standard of output, and turn off men who do not reach it. It is not likely to be greatly exceeded. There are few shops of this kind where a bonus system, with all its drawbacks, will not produce better results than any day-work system, however strong the control may be.—H. JAMES, *England*.

Executive Considerations in Tool Design and Production

By M. H. Flynn
Factory Manager, Allen Manufacturing Company

Before the tools are built for any product, a model should be built that is acceptable to the user, producer, and tool designer.

SINCE all of the items in the list on page 652, Vol. 70, of the *American Machinist*, affect the tool designer's work, they will be discussed in detail. The first and second items refer to the model of the article to be manufactured.

Models of mechanisms originate in many ways. They are often made by inventors who have little or no knowledge of mechanics or manufacturing, and sometimes by tool or model makers who have had no experience in production work. Rarely are the first few models of new ideas ready to be given to the tool designer, even when made in highly organized experimental departments, where production problems and manufacturing limitations are thoroughly understood. This is as it should be, for if inventors gave too much thought to manufacturing limitations many good ideas would not be developed. In this development of ideas by the model maker, manufacturing methods should be kept in mind, but they should not be allowed to interfere with the working out of designs.

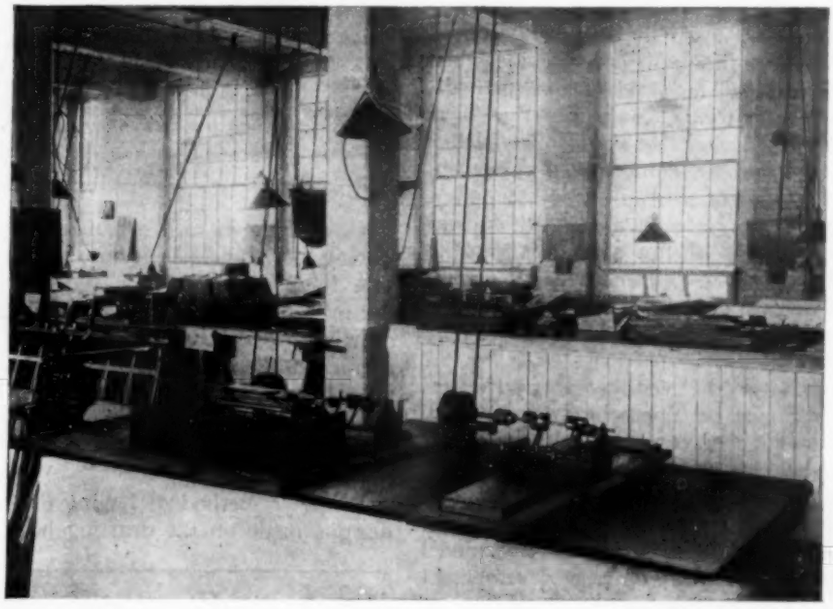


Fig. 8—This bench is used in a typewriter factory to make accelerated tests of typewriter parts. The wear that takes place in the normal life of any product may be reproduced in a few days by means of mechanisms arranged to operate the mechanical motion at a high rate of speed.

Frequently new ideas are worked out that require new and advanced methods and machinery for their production. It is best to make a model that performs well the function for which it is designed, and to redesign it from the producer's viewpoint and with his help. With such co-operation new methods of manufacture may be developed.

The main trouble in many plants is that this redesigning is either not done at all or not thoroughly enough. There may be several reasons for this, two of which are: Lack of funds, and an undue desire for speed in production. Neither of these are good reasons for not redesigning, because a careful study of any article to be manufactured, especially if it is not a very simple device, should decrease the cost and time of production.

The principal reason why new devices are not properly prepared for manufacture before starting the tools is that the owner or engineer, or both, often do not realize the importance of doing this work. Many instances may be cited of tool designers who have been forced against their better judgment and advice to design tools for parts that were costly and difficult to make, when a change in the mechanism would have simplied both parts and tools. In this early redesigning of models the user's requirements and desires should be studied carefully as well as the producer's. Many machines have been put on the market to be withdrawn quickly because of criticisms of the users. Such an experience is costly and detrimental to the concern's reputation, and may be avoided if the owner will make a careful investigation from the user's viewpoint before preparing to manufacture.

This redesigning is as necessary in putting forth a new model of an article that has been marketed successfully, as it is in presenting an entirely new device to the public. Some owners manufacture an article for several years without making any change in it, and the manufacturing methods that were the best obtainable when installed are used profitably for long periods of time. Model makers, engineers, tool designers, and even toolmakers and machinists not required for replacement work

The second part of the article. The third part will appear in an early issue.

PART LIST

BARR TYPEWRITER

GROUPS

10000	Base and Frame	80000	Back Space
20000	Type Bar and Segment	90000	Line Lock
30000	Key Lever	100000	Spring Drum
40000	Escapement	110000	Margin Stops-Bell
50000	Carriage	120000	Carrying Case
60000	Platen	130000	Special Parts
70000	Ribbon		

PART LIST

BARR TYPEWRITER

ESCAPEMENT GROUP

40600A	Escapement actuator assembly (Obsolete from mach. #2000)		
40601A	Escapement actuator assembly (Used from mach. #2001)		
40610A	Escapement actuator contact arm assembly (Obsolete from mach. #2000)		
40611A	Escapement actuator contact arm assembly (Used from mach. #2001)		
40610	Escapement actuator contact arm		1
40620	Escapement actuator contact arm shaft (Obsolete from mach. #2000)		1
40621	Escapement actuator contact arm shaft (Used from mach. #2001)		1
	Escapement actuator contact arm dowel (same as 31160 1 used)		
40630	Escapement actuator contact arm shaft bracket (Obsolete from mach. #2000)		1
40631	Escapement actuator contact arm shaft bracket (Used from mach. #2001)		1
40640	Escapement actuator contact arm shaft bracket screw (Obsolete from mach. #2000)		2
40641	Escapement actuator contact arm shaft bracket screw (Used from mach. #2001)		2
40650	Escapement actuator adjusting block		1
40660	Escapement actuator adjusting block dowel	1	4
	Ribbon spool drive pin	2	
	Line space lever pin (used from mach. #2001)	1	
	Escapement actuator adjusting screw (same as 40450- 2 used)		
40670	Escapement actuator contact arm shaft bracket clamp (used from mach. #2001)		1
40680A	Escapement actuator adjustor assembly (Obsolete from mach. #2000)		
40681A	Escapement actuator adjustor assembly (Used from mach. #2001)		
40680	Escapement actuator adjustor		1

Figs. 9 and 10—Typical machine part lists showing assemblies and the individual parts in one of these assemblies

Before putting in production a machine having many parts, it should be divided into assemblies, standard names chosen for the parts and assemblies, and complete part lists made up for each group. These will form a working basis to get the tools started, and will promote orderly production later on. A decimal, or digit, system of group numbers, such as shown in Fig. 7, is a comprehensive one, as it gives ample reserve for new parts. In Fig. 8 is given a typical listing of the parts of one assembly. The drawing of the model part is filed under the number, and the tools have the same number with a symbol.

are dismissed to cut down the burden. An owner who does this, and who fails to maintain some organization for the purpose of keeping his product and manufacturing methods up-to-date, will learn that he has practiced false economy, because the time will surely come when he will be obliged to improve his product and methods, or surrender to his competitors. Companies that have been dominant in their field, and that have followed this method of manufacture without doing any development work, when forced by competition to a change of policy, have spent the profits of years and have been driven near or into bankruptcy, because of the cost of trying to develop new models and up-to-date methods of manufacture with a hurriedly gathered force of engineers, tool designers, toolmakers, who had to be trained before they could function successfully.

From the foregoing, it will be seen that a manufacturing concern should not stop development work entirely. Its product, and that of its competitors, should be studied constantly. The method of carrying out this study will vary, of course, with the size of the company and the type of product. In a small company the owner might do all of it. In large companies experimental and model departments are maintained just for the development work.

In some companies the development work is done by experimental mechanics who work out their ideas in metal. It is a costly process to allow high-priced mechanics and model makers to spend their time thinking out designs and making parts for an experimental mechanism. Sometimes this method must be employed, but it is possible to do good work rapidly, and at low cost, by means of the drafting board. With this method many designs may be made and studied in much less time than required to work out each suggestion in models. Fully-dimensioned, detailed sketches of the designs to be tested by means of models may be made, and the parts of the model then made carefully to the scale dimensions by apprentices, machinists or toolmakers, or in tools of similar parts in manufacturing departments. The parts thus made are assembled and tested by a model maker or an experimental mechanic. The model maker is relieved of the detail work, and can spend his time assembling and testing new work. In this way most of the development work is done in well organized departments as routine work under the supervision of competent foremen.

A further benefit is derived from this method in that the model drawings may be used in preparing working drawings for production instead of relying upon measurements taken from hand-made model parts. These detailed drawings also become records of what has been done, in case the parts are altered or destroyed by the model makers or are lost. They may also be used as patent records.

With the method of having the model maker work to designs made on the drafting board, better designs and

R T CO. INC FORM P-187

SPECIAL

Date_____

Part_____ No._____

Operation_____ Quantity_____

Remarks_____

Return Parts with Card to

D-15

Order No._____ Model Maker_____

Fig. 11 — The card used by one company to put model parts through the manufacturing department, instead of having duplicate models made by high-priced model makers, thus making large savings. The card is bright red in color and of large size so that all persons concerned will know that the parts are special

ACCOUNT NO.	LOT NO.	DATE REQUIRED	DATE ISSUED	NO. OF PIECES	PART NO.
48					4056

PART NAME

Transfer Lever Latch

OPN.	OPERATION	DESCRIPTION OF OPERATION	PIECES COMPLETE	DEPT.	MACHINE GROUP	TOOL SYMBOLS	TOOL LOCATION	BONUS RATE	EST. TIME
1	1	Blank		P	2FP	4056-J1		2500	
						3J3			
2	2	First Bend		P	1FP	405812		350	
						1478 (upside down)			
						405801			
3	3	Second Bend		P	1FP	405873		300	
						1J3			
						405801			
4	200	Burr holes if necessary		D	DS			400	
5	202	Grind		D	GT	405874		210	
						405802			
6	400	Remove grinding burr		D	KX			250	
7		Inspect				405802			
8	300	Case Harden		HT	FC				
9	500	Dull nickel plate		NP					
10	401	Bring all points to gauge		D		405801			
						405802			
						405876		120	
11		Inspect				405801			
						405802			
		stores							

MASTER CARD

SPECIAL ROUTING AND REMARKS	DELIVERIES: COMP.	DELIVERIES: RAW	THIS LOT HAS BEEN DIVIDED AS FOLLOWS: NEW LOT NUMBER	PCS. IN NEW LOT	OPERATION COMPLETED	DATE AND TIME NEW LOT WAS COMPLETED

Fig. 12—Advance layout of operations and tools for making a part

This master card, planned out originally by the chief engineer and the tool designers, gives in detail all operations necessary to make the part and the tools and equipment reqnired. The tool numbers correspond with the part numbers, but have an added placement symbol and number. From this advance summation, costs of tools required and operation costs can be estimated so that the management can be given an advance cost estimate on the first lot of machines. This same blank form, with a printed reverse, as shown, is used later for recording lot orders placed in the shops.

less costly models are produced in very much less time than by the method of cut and try by the toolmaker. Changes and improvements in models may be made quickly and accurately and with a permanent record, when the first model is made from a carefully worked out drawing. This results in much saving of time and money.

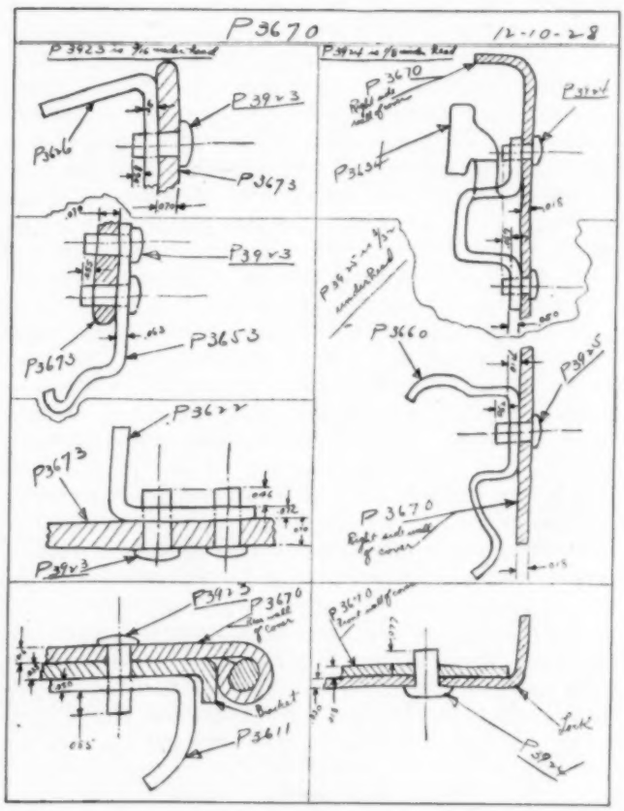


Fig. 13—Sketch of proposed rearrangement of parts

How one plant making office machines records the suggested changes in product is shown in Fig. 13. A free-hand sketch of the original suggested change is made in a book in the office of the chief designer, and a sketch of such as shown here is given to the model maker. This type of sketch is used only where the parts used are standard and implies only a re-arrangement.

Experimental model work may become, if not carefully controlled, a heavy burden compared to the results obtained. Many methods and devices to decrease this burden are used. Photographs of intricate mechanisms that normally run at high speed may be made of the mechanism in various positions in its cycle, and used to study the action of the mechanism, to find interferences, and to develop patent or assembly drawings.

Tests of mechanisms are made which will produce in a short time the wear and deterioration of years of normal use. These accelerated tests, which may be worked out at low cost with a little ingenuity, in many cases enable the engineer to determine the value of a proposed mechanism without waiting long periods for the device to be tested on the market. In this way unexpected weaknesses are discovered and corrected before tools are made.

Tests of completed models are made by others than the model makers. A man who has designed and built a model of a device may have produced a model that meets his requirements fully. From his point of view it may be perfect, yet he may not be qualified to judge. He may have concentrated so closely upon the mechanical problem that he had to solve as to have overlooked other and more serious problems. Many models that work perfectly in the hands of the model maker cannot be transported to other places, and will not function at all under normal usage.

Before tools are made every device should be tested under the conditions that will exist after it has been produced from tools. Laboratory tests are not sufficient. Shipping tests and tests by those to whom the device is to be sold will often bring forth suggestions and changes that may be made in the model. Otherwise changes in the product will have to be made after production starts, at a considerable loss due to discarded tools.

After a model has been accepted, it should be redesigned before tool work starts. In this redesigning many things should be studied. The user's requirements; the manufacturing methods and cost; the choice of materials; the type of finish—all need special study.

The user's desires, of course, should be satisfied, but the tool designer and producer should be considered also. The materials used greatly affect the tool costs. There

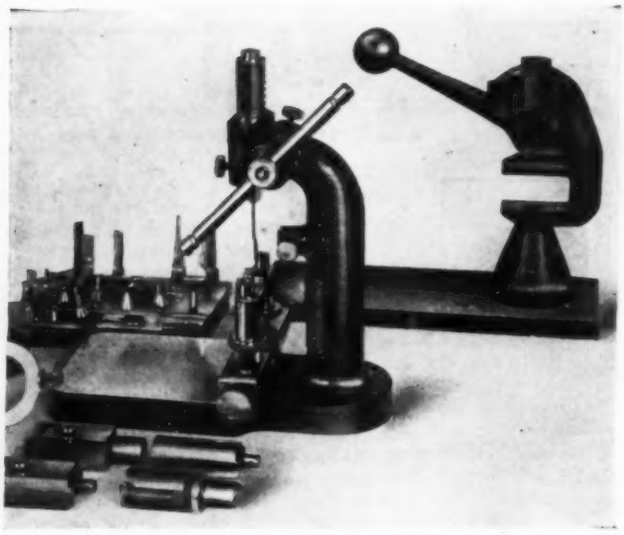


Fig. 14 — In the background is shown the inventor's original model of a dental machine. Before making tools to manufacture this unit, it was very carefully redesigned as shown in the foreground, so that it could be produced more easily in the shop. In return for this preliminary expense for the designer's time, the result was a better appearing design of machine besides a reduced manufacturing cost

is a great difference in the cost of tools for machining castings made in sand, permanent molds, or dies. Each presents its own peculiar problems. A part might be made of an iron, brass or aluminum casting, a steel forging, sheet metal, carbon steel, or alloy steel, and each material may require a special type of tool for machining. Often after tools are made, it is found necessary, in order to increase the strength to increase or decrease the weight, to improve the finish, or to lower the cost, to change from one material to another, and to make a new lot of tools. Careful tests and redesigning will prevent this loss in many cases. Money spent in studying and reworking a device to prepare it for manufacturing should be returned many times over by the decreased cost of designing and making tools and producing the parts.

Congestion at the Machine Tools

By J. T. Saville, *Foreman*
London, England

THIS is the lament of a machine shop foreman over the increasing practice of machining instead of fitting in Great Britain. Not for many years has there been such congestion at the machine tools in this country as there is at present time. It also seems that never were the bench fitters so incapable of helping the machine shop through.

More and more work is being done by machine that was formerly done by the fitters, and where promises of delivery are not kept, the cry goes up, "Waiting for the machine shop."

It is suggested that the machine shop of a large plant not only deserves consideration, but needs it. While at times the complaint of the foreman fitter is a legitimate one, often it is not. The usual complaint and the foreman's reply is something like the following: The production chaser comes to the machine shop foreman and says: "The fitters are waiting on you."

"Who the —— said they were not?" the foreman comes back. "Why do you suppose we would be running these machines day and night if all the machine work was done? What are those anxious fitters doing while they are waiting ostentatiously for the machine shop? Isn't there someone in the whole concern with gumption enough to see that the fitters produce something while they are waiting? What are they really waiting for anyway?"

The production man is taken aback and he answers, "I don't know; I will go and find out." He finds that a dozen handwheels with $1\frac{1}{4}$-in. bore and a boss $1\frac{1}{4}$ in. thick require a $\frac{1}{4}$x$\frac{5}{32}$-in. keyway.

"How long have these men been waiting?" asks the foreman. "A whole day," replies the production man. "Well," storms the foreman, "don't any of your fitter crowd know what a $\frac{1}{4}$-in. crosscut file looks like? And do you not know that before us machine foremen were made lackeys to decadent bench men, we cut such keyways at a penny a piece? Can't fitters cut keyways any more? You go back and tell that fitter foreman that if he don't teach his men to use a hacksaw and file, and help out when the machines are crammed, there will come a time when he will be sorry." And so it goes. It is difficult to make people realize that so important a change should be gradual.

Some Kinks in Jig and Fixture Design

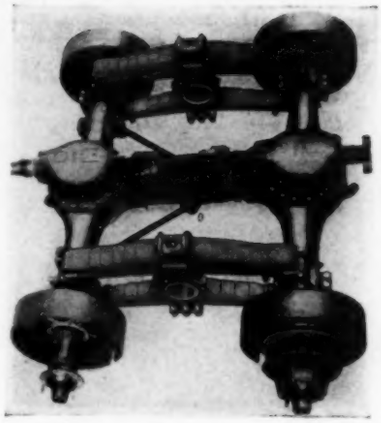
By Harvey S. Hinchman

VERY often in large manufacturing concerns, where parts are produced on a large scale, thousands of dollars are lost annually due to improper procedure in the designing of jigs and fixtures. One of the very first operations in preparing a working plan of a tool is to lay down the part on the drawing in red ink, which will reproduce a faint line on the blueprint. After this is completed, the tool should be designed around the part. In many instances these tools are subject to continual handling by the workman. In this case the matter of weight should be considered. If unnecessary material is used, it will add an extra burden on the operator and consequently retard production.

Every precaution should be taken to make these tools "foolproof"—that is to say, they should be constructed so that the part can be held only in one way. If there is another way of securing the part, regardless of how vague it may be, at some time or other a new operator will discover it and may continue to do so for several days before it is noticed, with high spoiled material costs in consequence.

In dimensioning the drawing, every point should be located from a true center line. It has been observed that in many cases the designer will start at the center line and dimension one point from another, thereby introducing the possibilities of accumulated errors. If this is done and the plan gets to the shop, there is no question but that the toolmaker will lay out the work in the same manner, and as a result, the parts will not go together accurately.

One reason that some good suggestions are lost to the company is that the men fear to offend the foreman. This comes from the idea that a suggestion may be taken as a criticism of existing methods for which the foremen may be responsible. The foreman who can dispel this fear will get many good ideas for improvement about the shop.



Rear-Axle Housings For Dual-Drive Trucks

By Frank W. Curtis
Western Editor, American Machinist

Procedure carried out in making cast-steel axle housings in a Pacific Coast motor truck plant

SEVERAL models of the trucks made by the Moreland Motor Truck Company, Burbank, Calif., are built with dual drives, consisting of two rear-axle assemblies linked together by an intermediate drive shaft, so that all four wheels are driven. The truck load is distributed evenly on all four rear wheels, since a balanced suspension, consisting of main and auxiliary springs, is used. Two cast-steel axle housings of similar construction, carrying the worm gearing, axle shafts and intermediate parts, are of nickel-steel, and are made by the electric furnace process, having a carbon content of 0.30. In Fig. 1 the construction features of one of the housings for the type TD models is illustrated.

Production requirements for the various housings do not warrant high-production methods. Orders are run through in lots of from 25 to 50 trucks at a time, and the methods of manufacture are arranged accordingly. Tooling is designed to insure interchangeability, and to allow of a fairly rapid tool change from one model to another. The operations required to machine the housing, are:

1. Rough turn ball joints
2. Face and turn flange ends and rough bore 4¼-in. holes
3. Finish turn radial ball joints
4. Bore and face bowl
5. Mill hinge pads
6. Mill locating slots in flanges
7. Drill, counterbore and tap bowl complete
8. Drill flange holes and finish bore 2¼-in. hole.
9. Bore ends for bearing sleeves
10. File, clean and inspect.

One of the requirements is to have all surfaces concentric and in correct location to one another; therefore, in setting up for the first operation the work is chucked in a lathe and checked for alignment to assure having the various surfaces clean up in subsequent operations.

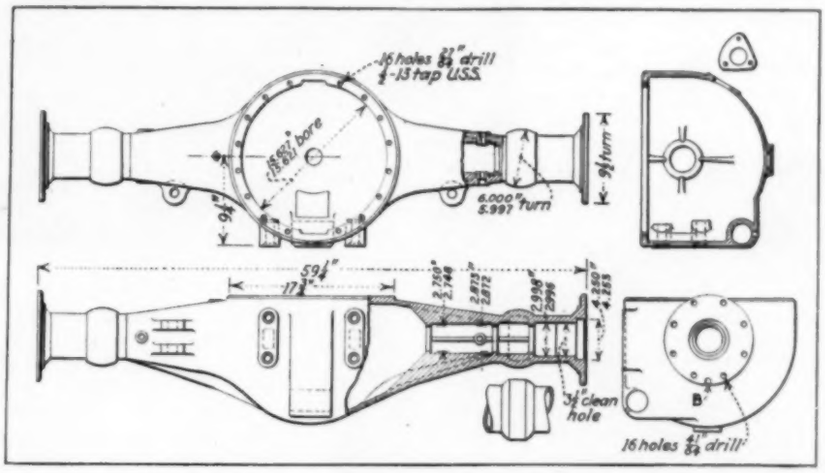


Fig. 1 — Constructional features of one of the rear-axle housings showing the various faces requiring machining

Inasmuch as the castings are made with unusual care, there is little difficulty in obtaining a satisfactory registration from the end flanges. In rough machining the ball joint, the outside diameter is turned with a flat as shown at *A* in Fig. 1, which permits the use of a steadyrest in the following operations.

The flanges are turned and faced in a lathe, one end being chucked while the projecting end is supported by a steadyrest. After the flange at one end has been finished, including the rough boring of 4½-in. hole, the work is turned end for end, re-chucked and supported in a similar manner, so that the opposite end can be finished.

Next in order, the ball joints are finish turned as illustrated in Figs. 2 and 3, one end being chucked by the flange, and the other end supported by a ball center. The tool holder for finishing the ball is mounted on an auxiliary tool block attached to the ways of the lathe. The tool holder is connected to the base, so that it is free to revolve, although its radial motion is controlled and operated by a connecting link attached to the main tool post at the left. After a ball at one end has been finished, the work is turned end for end and the operation is repeated. After this operation is completed, the flanges and ball joints are concentric with one another, thus allowing these surfaces to be used as locating points for the succeeding operations.

The next operation is the machining of the bowl face which is done in a manufacturing-type milling machine by locating the housing on two V-blocks as illustrated in Fig. 4. The work is seated on the two finished ball joints. End location is attained by the plug *A*, which registers against the inside face of the flange. The boring and facing cuts are done by a star-feed facing head, as shown in the close-up view, Fig. 5. Both operations require roughing and finishing cuts. By releasing the clamping pressure, turning the work 90 deg., and re-

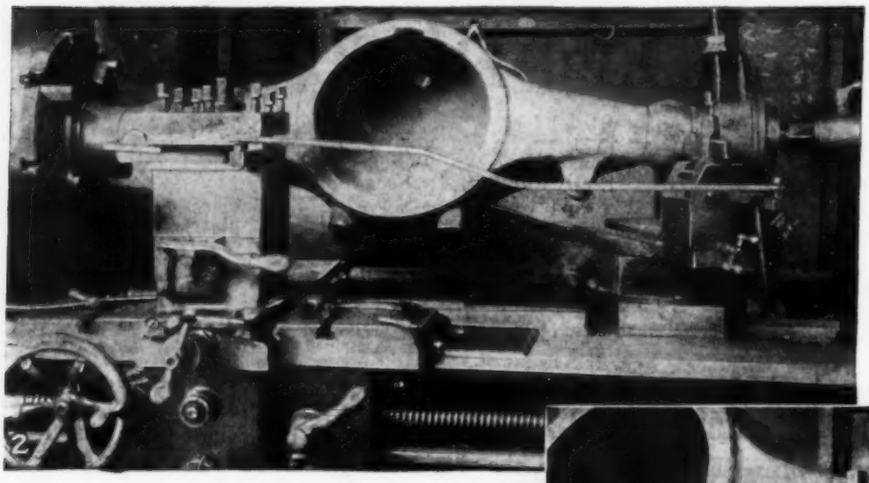


Fig. 3—A near view of the finish turning operation for ball joints. The tool holder is of the swivel type controlled by a connecting link attached to the main toolpost and operated by the longitudinal feed of the carriage. The illustration shows the method of applying a ball center in one of the flanged ends. The operation is finished by reversing the position of the work for the opposite ball joints

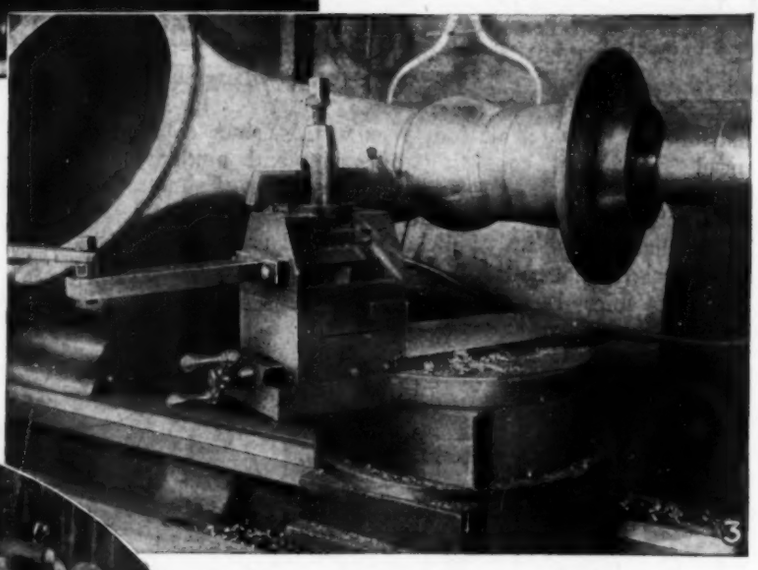


Fig. 2 — Prior to machining rear-axle housing castings, they are set up in a lathe and checked for concentricity and alignment. The castings are of steel and are made by the electric-furnace process. After the flanges have been machined the ball joints are finished as shown. Driving is from a four-jaw chuck and the outer end is supported by the previously bored 4½-in. hole

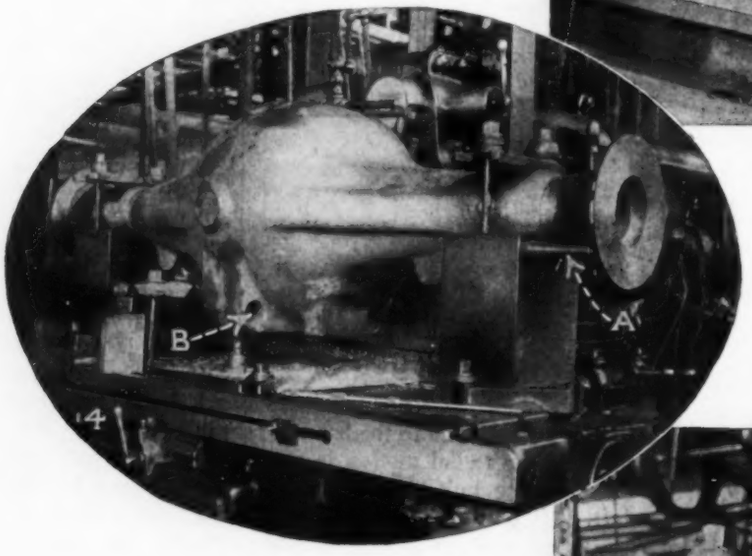


Fig. 5 — Boring and facing of the bowl is done by a star-feed cutter mounted on the spindle of the milling machine. Both operations require a roughing and finishing cut. The same set up is used in connection with the milling of the hinge pad by merely relocating the radial position of the work to suit

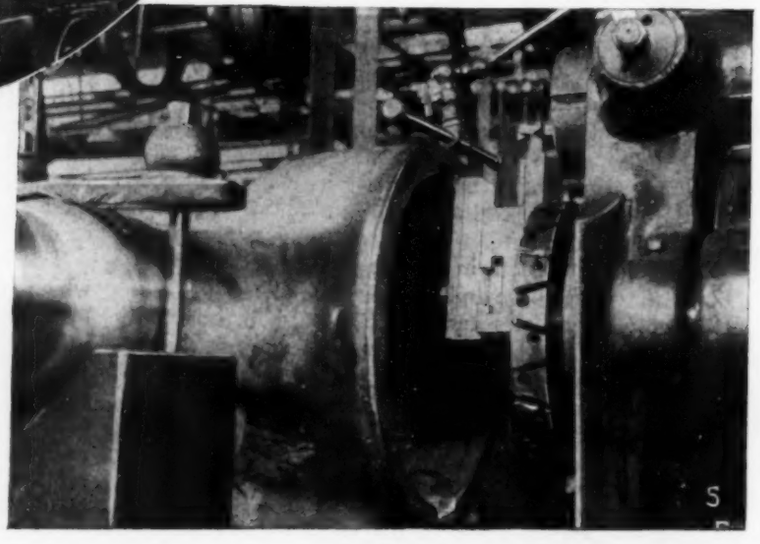
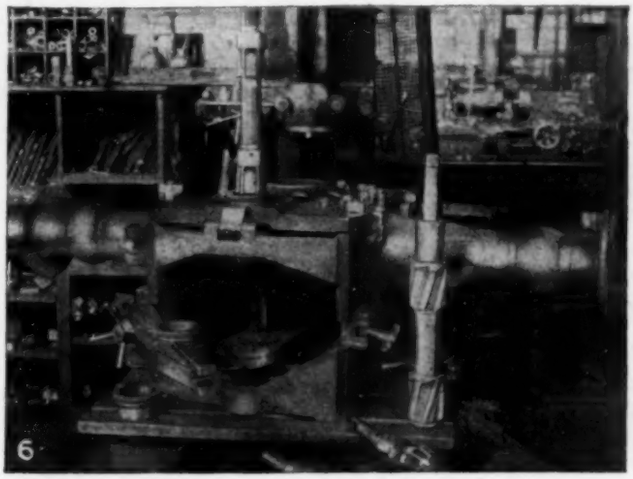


Fig. 4—Milling of the bowl face is done by setting the work on two V-blocks using the ball joints for alignment. End location is attained by a plug, located in one of the V-blocks, which strikes the inside face of the corresponding flange. In this position the work is held in place by two strap clamps



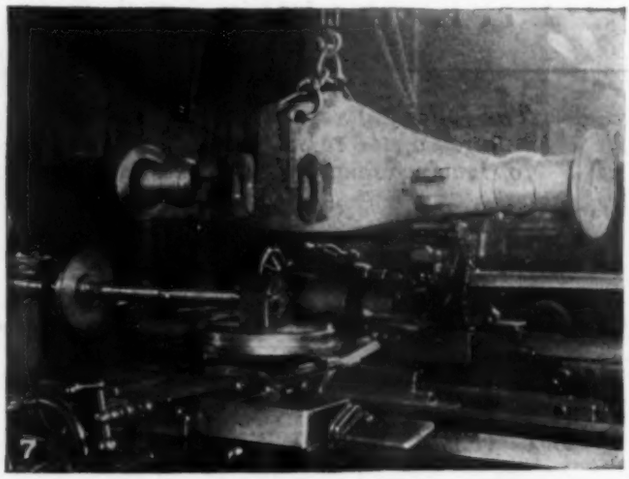


Fig. 6 — All bowl-face holes are drilled at one setting in the drill jig shown. The flange holes are drilled in the same machine by lowering the work on a base that sets below the floor level. Fig. 7 — Boring the sleeve holes. The work is shown removed to illustrate the method of supporting the boring bar in an outer bearing on the fixture. The operation includes rough boring and finished reaming using floating-type reamers

clamping, the fifth operation, that of milling the hinge pads, is handled in the same fixture, although the machining is done by an end mill and the work is fed in a vertical plane.

Drilling, counterboring and tapping the various holes in the bowl is done in a radial drill as illustrated in Fig. 6. Location and alignment of the housing is secured by registering from the various faces of the bowl, but on some of the models alignment is by means of a milled slot in one of the end flanges, as illustrated at *B* in Fig. 1. The jig for this latter type of location has an extending arm carrying a gage block that fits in the slot, thus assuring a correct radial setting.

A plate jig, placed over the flanged end and registered from the milled locating slot, is used for drilling the eight $\frac{11}{16}$-in. holes in the flanges. The $2\frac{1}{4}$-in. end hole, shown at *B*, Fig. 4, is finished at the same set up. On account of the length of the housing, it is necessary to rest the work on a jig base that is positioned about two feet below the surface of the floor. This permits the drilling to be done without difficulty in a radial drill.

The final machining operation is boring the axle-shaft hole at each end of the housing for the sleeve fit. The operation is done as shown in Fig. 7 which shows the housing removed from the machine, and exposes the fixture used for centering it and also the outer bearing for the boring bar. Location of the housing is from the bowl bore, and alignment is secured by a plug inserted in the previously bored $4\frac{1}{4}$-in. hole. The roughing cut is done by double-point boring tools and finishing is by floating-type reamers. Both cutter bars are supported from a bushing mounted on the cross-slide face and driven from the spindle. The fixture is located on the cross-slide face by a tapered dowel pin that passes through the fixture and enters the top face of the carriage.

Preventive Maintenance—*Discussion*

By H. James
Birmingham, England

I SHOULD like to underline the statement on page 315, Vol. 70, of the *American Machinist*, reading as follows: "A system of inspection for small cracks and distortions properly carried out will prevent many a breakdown."

The following instance is cited to prove this point: In one factory, employing nearly 10,000 workers, where such a system is in force, the whole of the skilled maintenance staff was absent during the ten days of the general strike of 1926 in England, and the machinery was left to take care of itself. It speaks well both for the system and for the staff that not a single breakdown of any account occurred despite the fact that the machines and operators worked as usual.

In the system adopted in this plant all machinery in a department or group of departments is put in charge of a maintenance sub-foreman who has the assistance of a small staff of mechanics and perhaps of a pipefitter, sheet-metal worker, and oiler. This sub-foreman is expected to keep all machinery in his charge continuously in running order and has to account for all waiting time booked against him by the production foreman. In his own interest, therefore, he keeps his eyes open for every sign of failure, and regularly inspects every working part of every machine and knows every bearing individually. When the proper time comes he tells the production foreman that a certain machine ought to be withdrawn from production on a certain date for a specified period for overhaul, and the foreman then has to arrange for the machine to be freed at this time or take on himself the responsibility for any delay that a breakdown might cause. Generally, spares are obtained well in advance of the time when they will have to be used.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Stirring Up the Foremen on Accidents

"SEEMS to me, Williams is getting all 'het' up over the safety question, Al. He's been raising Cain for that accident to Jack Hart last Saturday. It wasn't a very bad accident, only a busted arm, and it was largely Jack's own fault, anyhow."

"A busted arm may not be much of an accident, Ed, when it's the other fellow's arm. But it's a real accident if it happens to be your arm, especially as they don't always get set straight and proper so as to be as good as new. But it isn't the seriousness of the accident, Ed, as much as it is that it never should have happened. Bill Smith didn't see to it that the guard was back in the machine and Jack slipped and fell into the pulley."

"But we have mighty few accidents, Al, considering the size of the shop. Other shops have a lot more."

"That isn't the question, Ed. Here was an accident that needn't have happened. If that guard had been in place, Jack couldn't have fallen into the pulley, and he'd be on the job now, just when we need him the worst way. All accidents cost a lot more money than appears on the surface."

"Well, what is compensation insurance for, Al? It's too bad, of course, about Jack, but accidents are bound to happen."

"You've got the wrong slant, Ed. Accidents do happen when we get careless. But this accident wasn't bound to happen, it did happen because Bill wasn't on to his job.

"And don't think that the only cost is what we pay the accident insurance company. That isn't a drop in the bucket in many cases."

"Well, what else is there for the firm to pay—doesn't the insurance company pay?"

"Sure they pay Jack, but look what the company pays besides the premium. It pays the loss on Jack's production while he is laid up. Then there's the machine time loss, for even if someone else runs it, they are not likely to get Jack's production for several days—or weeks."

"Then there is the lost time due to everyone's wanting to help Jack, the time lost in talking it over and cussing out Bill Smith because the guard wasn't on. There is the general shakiness, or nervousness, that affects the morale, and the work, of practically every man in the department. These things cost real money, Ed, and Williams knows it."

"Personally, Al, I can't see much use in making such a fuss after it's over. It's too bad, of course, but it isn't likely to happen again. So why worry so much over it?"

"If Williams didn't make a fuss over it, Ed, it might happen a lot sooner than it's likely to do now. Williams only wants to get us all to thinking about safety—and keep thinking about it. Safety is a sort of habit."

Is Al over-emphatic about safety? Does he exaggerate the cost of accidents? Is Ed right in thinking it wasn't of much importance?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Shall Men Clean Their Own Machines?

THIS axiom about the "pride of possession" of the average mechanic in his tools, equipment and the appearance of the plant in general, is wonderful to contemplate and visualize in the mind's eye, but it just doesn't seem to be applied in practice by the majority of mechanics. Some men just naturally take good care of everything they own or use, others are content as long as things keep running and forget about cleanliness. The practice of having each man keep his own machine clean has been the prevailing one, and with the path of policy strewn with the wrecks of machines that have been hastened to an early demise by neglect, why not try a different procedure?

It is certainly in line with the trend in modern production to sub-divide tasks as far as practical, so that each man performs a specialized operation. It doesn't seem unreasonable to place machine cleaning in this class, particularly when it is possible to bring to the job in this way, specialized equipment which makes the work easier and more thorough. I feel confident that the individual machine operator never did hanker after the job, and will appreciate the change. —B. E. LAMBERT.

Spending Money for Oiling Equipment

AUTOMATIC oiling on intricate and expensive machine tools, or in fact anywhere that multiple oiling is necessary, is by far the safest and cheapest. The large drawing press that Al speaks of may run for a long time with the operator doing the oiling, but someday, and of course during an important job, a neglected bearing will freeze and cause trouble.

The Exit Interview

I AM inclined to think that the exit interview has its merits, particularly in large organizations. In the small organization, where the "big boss" keeps in intimate contact with the men, there is no necessity for it. In a medium sized organization, this function is to a certain extent supplied by the superintendent, while in a large organization the "Super" applies himself to coordinating output and leaves personnel to an employment manager. With the right kind of an E.M., the exit interview furnishes the superintendent with check data just as checking up certain jobs verifies the production reports he receives.

No foreman can reduce turnover greatly unless certain factors beyond his control are favorable. Living conditions in the community, competition of other concerns for his men, the prevailing wage scale as compared to other organizations, the general status of prosperity in his town and the reputation of his firm among the workmen are all important factors influencing turnover. But to keep it comparable with other concerns doing similar work under similar conditions, or with other departments of his own firm, is within his power, and is what he should be held responsible for. —ERNEST E. LAIB.

THE · NEXT · TOPIC

Modernization

ADVANCE QUESTION

For the first time in his shop life Ed agrees with his fellow foreman. The point of discussion is the foreman's stake in modernization of equipment. Do you agree that the foreman has a real interest in helping the plant to be up to date on equipment?

Helping the Tool Designer

ONE of the large manufacturing concerns has set up the following rules in regard to tool design. Through this method only the highest type of tools are placed on the job, thus minimizing breakdowns throughout the production time. When a new tool is required, it is the duty of the departmental foreman, or production engineer coming into contact with the job, to draw up a rough sketch of the tool, which together with a tool requisition, is approved and sent to the tool design department. The information written on the tool design requisition must cover the use of the tool, the possible saving which it will accomplish, also the name of the department using it, and any other information required. The chief tool designer after studying the work in hand turns it over to one of the tool designers, who at once contacts with the person issuing the request, and the entire situation is discussed thoroughly. Upon returning to the drawing room, an assembly design of the tool is drawn up and given to the chief tool designer, who sends it to the shop executives concerned for the necessary signed approvals. If the latter have better ideas to incorporate in the design, it is taken to the chief tool designer, who calls the tool designer into conference, and the necessary changes are decided upon.

—FRED AUG. SCHMIDT, *Industrial Engineer*.

I DO NOT think it is part of the foreman's job to help the tool designer, for he should know enough about his job of designing to stand on his own feet. But, if it's a case of co-operating with him, to the mutual ad-

vantage of both men and primarily the organization itself, that is another story. I believe that in a fair exchange of ideas and reactions, the tool designer can give the foreman quite a bit of aid as well. Many a foreman can learn something in these contacts about the care of fixtures, their wear, set-up and storage that will often decrease rejection and prolong the useful life of the fixture. In little kinks such as these, brought out in casual conversation, the tool designer can compensate the foreman for the useful practical facts and ideas the foreman gives him. If the tool designer, however, is merely a human sponge soaking up the foreman's ideas, I'd be like Ed—willing to let him run his own job without my aid. —FRANK M. TUOHY.

AS THE foreman happens to be the one who has to use the jig and get out the production from it, he certainly should be consulted. In every instance that comes to my mind the foreman was able to add some of his practical knowledge to the theoretical knowledge of the designer with results satisfactory to both.

In one case we needed a small contrivance to turn down the ends of some long rivets. The jig was designed and made before the foreman knew what was going on. As it turned out it took longer to put the rivets in and take them out than it did to machine them.

The jig in itself was all right, but no production could be made with it. It was discarded after a short test and another one was made in which both designer and foreman had a hand and it exceeded expectations.

It is bad policy to force a jig on a foreman when he knows that given a chance he could have suggested small alterations which would help the job greatly. Even in cases where it doesn't appear that he can add anything substantial, the mere fact that he is consulted will make him feel as if he had part in it and assure his good will. —F. H. WALGENBACH.

FOREMEN can often point out the advantage of adapting a fixture to machines which are not used often, and route the work for which the fixture is to be used away from machines already overcrowded, they being in the best position to know this. Their experience may guide the choice of material to that which is most readily worked or which wears best. Often he may know of an obsolete fixture, that is unknown to a tool designer, which can be modified or adapted to use at less expense than a new one can be made for. The foreman knows from experience the difficulties encountered in previous fixtures, which while they appeared perfectly good on paper, simply wouldn't stand up on the job, and can point these out to the designer. In fact the foreman can point out those one hundred and one little details which come only from long experience with a certain class of work, and which make the difference between a good design and one which merely works for a time. —E. L. FAIRALL.

AL IS right as to its being part of the foreman's job to help the tool designer, but not in the strictest sense. Where to stop helping is that same fine dividing line which is the fighting point between co-operation and co-ordination. Who can define that line? Results are so baffling in their connection to pure logic that it appears best to leave the solution of individual cases to the common-sense of the parties involved.

Ed's objection is poor. He should have gaged his questioner, helped him anyway, and then, either gambled that the designer was motivated by a spirit of constructiveness or have reported to the designer's superior that he did not approve of the responsibility placed in that particular designer. That way may seem harsh, but it is my conception of Ed's duty in the matter.

Al seems to have supplied himself with enough loopholes so that we cannot say that he hasn't caught the real reason for the designer's questions.

In my opinion the designer knew his stuff, Ed is trying hard to learn, and Al is one of those boys who is letting Ed learn for himself by the suggestion method because it's the surest way to learn and it's the easiest way to teach.

—RALPH W. LAKE, *Fabricating Foreman. The Lamson Company.*

Instructors for Shop Men

THE fact that quite a large number of up-to-date concerns make use of demonstrators to prove the accuracy of piecework rates proves Al's optimism to be justified. Here, for example, are the terms of a recent inquiry for men of this description from one of our largest motor manufacturers:

"Applicants must be thoroughly trained shop men, capable of setting up and demonstrating any type of machine, and fully conversant with modern methods of time study. Men with experience in high production methods and intensive tooling are desired."

If it pays big firms to do this, surely a proportionate gain can be secured by a smaller one. Ed's point of view is correct in that we ought to be able to demand equal efficiency, but we all know we do not get it. It is all right to say men have to learn in the shop, but who is it that pays while the learning it going on? The firm, surely, through the reduced output.

—J. H. HARGRAVE, *England.*

Shall a Man Sit Down to Work?

WHERE a job can be done equally well sitting or standing, provision should be made for the man to sit if he desires, that is, the job should be arranged so that he can handle it standing, and then a seat of suitable height should be provided.

Either standing or sitting causes exhaustion if one position must be maintained for too long a time, and it is often as restful to stand after sitting as it is to sit after standing.

Operations suitable for being performed while sitting are usually those in which the movements are short and where no great energy is required to perform them. Where physical effort is necessary in the performance of an operation it is usually better to be on the feet, so that the weight of the body can be swung to help in performing the task.

In the case of very delicate operations it is often necessary to steady the body or even the arm or hand, and to attempt to perform them in a standing position may interfere considerably with the accuracy or speed of working. —A. F. CUYLER, *England.*

Lost-Time Accidents *Cut 80 Per Cent* in Three Years

By Daniel Ross
John A. Roebling's Sons Company

Safety methods, backed by the management, with the co-operation of the foremen, save 80 per cent of former compensation costs

IN EVERY plant comes a time when the accident ratio assumes relatively serious proportions and vigorous efforts are imperative in order to call a halt. In the John A. Roebling's Sons Company plants, at Trenton and Roebling, N. J., employing approximately 6,000 workers, that time arrived in 1925. The company manufactures wire, cables, and similar products, and the ingot furnaces, rolling mills, and other places where hot metal is handled, offer greater dangers of serious accidents than are present in most industries, in spite of special safeguards.

Prior to 1925 there had been no fatal accidents in the plant for a number of years, and the records compared favorably with other companies where the risks were equally hazardous. However, the experience of that year was different. In 1925 four fatal accidents occurred, there were three or four serious eye injuries, and compensation costs took a decided jump. Such conditions demanded prompt attention and action by the management.

After a careful study of the situation, and an investigation of the progress in accident prevention which other plants in the metal-working industry had made, the general manager developed a definite safety program. He called a meeting of all the superintendents and foremen, pointed out the unfortunate record of the preceding year, and outlined methods which would reduce accidents in the plant. The meeting aroused unusual interest, and a number of useful suggestions were made regarding the best way to put the safety drive across.

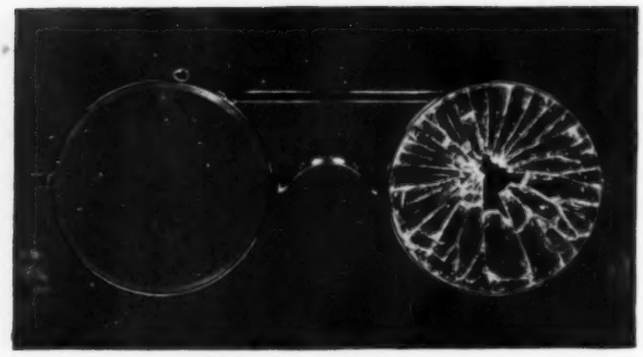
A central safety committee was appointed, consisting of the general manager, as chairman, the chief engineer, several superintendents, and the plant physician. A safety inspector was selected to investigate all accidents and to serve as secretary to the committee. Monthly committee meetings were held at which all lost-time accidents were reviewed, recommendations on accident prevention were analyzed, and the details of the safety program were planned and brought up to date.

One of the important steps taken was to secure the co-operation of the foremen. Since foremen directly supervise all processing operations, and are in intimate daily contact with the workers, they are in a better position than anyone else in the plant, not only to discover and correct the greatest sources of danger, but also to drive home the safety thought most effectively to the particular types of workers coming under their authority. In order to acquaint the foremen and supervisor with the organizing and operating of a successful safety program, and methods by which the ideas might be most successfully impressed upon the employees, a series of safety meetings were held. At these meetings talks on various safety topics were presented and motion pictures were used to bring out the points discussed. The meetings served not only to assist the foremen in co-operating in the safety program, but also proved to them the definite interest which the management was taking in the effort to reduce accidents.

This trophy was awarded to the plant winning three out of the five safety contests extending over three months each

During the first year it was necessary to do considerable educational work, so that the employees would understand the importance of the safety program and would endeavor to support it. Safety posters were displayed on the bulletin boards throughout the entire plant. Considerable space was given in the monthly plant magazine, the "Blue Center," to safety cartoons, slogans, and incidents regarding accident prevention. In this magazine was published also the standing of each department in regard to accidents during the preceding month. These various efforts aroused and maintained interest in the program so that a decided gain was made.

At the end of the first year a check up showed that the number of lost-time accidents had been reduced to one-half the number of the previous year. The interest taken by employees, and the practical value of safety instruction, are well illustrated by the following incident. Among the posters displayed on the bulletin board was one showing the prone pressure method of resuscitation. One of the employes paid particular attention to this poster and studied it care-



Goggles broken in service, but saving a man's eyesight, are mounted on a display board to drive home the safety idea

fully. Shorlty afterwards he happened to be near a stream of water when a canoe containing two men upset. One man could swim, but the other could not, so his companion had to support him until help arrived. The man, however, was unconscious when brought to shore. Due to what he had learned from the safety poster, the employee was able to apply the prone pressure method, and in a few minutes restored breathing to the unconscious man.

During the second year a further intensive effort was made to improve the safety record, and interplant and inter-departmental contests were conducted. Our two plants are located at Trenton and Roebling, which are situated twelve miles apart, and are about equally divided as to number of employees. A suitable basis, therefore, existed for interplant contests. The company offered a silver loving cup for the plant having the best safety record for a period of three months, based on the number of lost-time cases per man-hour worked. At the same time that this contest was put on, inter-departmental contests were arranged in each plant. Cups were also offered to the winning departments.

After three months the departmental contests were discontinued and the interplant contest was specially stressed. A large trophy was donated by the company, to become the permanent possession of the plant winning three out of five three-months' contests. This trophy was displayed throughout each plant and at the end of the first contest period it was turned over to the winning organization, to be retained until the end of the next contest period. This award aroused much interest because the losing plant was obliged to take the trophy to the winning plant and present it at the end of each three-months' period, with suitable ceremonies.

A summary made at the end of the second year showed a still further improvement in accident prevention. The record of lost-time accidents had been reduced to one-quarter the number of the previous year. In other words, the improvement was double that of the previous record, in spite of the fact that the first year's results were naturally much easier to secure.

After the trophy had been permanently awarded at the end of the five three-months' contests, a new plan was adopted to stimulate interest in safety work, and has been followed ever since. One hundred dollars in gold is presented to the plant winning the contest during each three months. Only employees who have had no lost-time accidents during the contest period, and who belong to the organization of the winning plant, are eligible to share in this award. The names of all such employees are placed in a barrel and one name at a time is drawn to determine ten winners, each of whom is given a ten-dollar gold piece. In order to make an equitable distribution of the award, only one winner is allowed to each department. At the close of each contest period all employes are invited to the public hall, where the drawings are made. At these meetings representatives of the plant management give brief talks on safety, following which a feature motion picture is shown.

Each month the safety committee makes a study of the accidents which have occurred, giving particular attention to those which proved most prevalent. Particular efforts are made to remove the causes of such accidents. Methods of prevention are presented and discussed at foremen training meetings. In this way many helpful suggestions are secured.

We found that eye accidents were particularly prevalent and were unusually serious. Consequently, employees engaged in work where there was any such hazard were supplied free with safety goggles. In cases where men were already wearing glasses prescribed by opticians, they were furnished with new safety prescription lenses. As a result of this precaution we have had no serious eye injuries during the past year. Display boards on which were mounted goggles broken in use, but saving the wearers' eyes, were especially helpful in encouraging men to use these protective devices.

The co-operation of foremen and supervisors was secured by a series of safety meetings at which talks on accident prevention were given, with motion pictures to illustrate the topics

We found also that toe injuries were very prevalent. Therefore we bought a quantity of safety shoes and sold them to the employees at cost. It is not compulsory to buy these shoes. Consequently, only a comparatively small percentage of employees used them. But none of the men wearing safety shoes have met with a foot injury.

Our committee has also issued a safety rule book, a

copy of which is distributed to every employee. In each case special attention is called to any hazards connected with the particular work performed by each man.

We discovered that, in many cases, men were failing to report their injuries until infections, or some other trouble had set in. To overcome this difficulty, we attached a penalty to any employee injured in the plant who did not report his injury within six hours. Since this rule was established there has been a marked increase in the manner of minor accidents reported, and infection cases have practically disappeared.

At the end of three years of special effort in safety work, we find that we have made considerable progress. Lost-time accidents have been cut 80 per cent during this period. Frequency and severity of accidents have likewise decreased in about the same proportion. Accident compensation costs have decreased each year. In 1928 they were 80 per cent less than in 1925.

The importance of safety was stressed by awarding the safety trophy to the winning plant, with appropriate ceremonies, before assembled employees

For many years it had been the practice of our company to install and maintain guards and safety appliances wherever possible throughout the plant. The improvement in our safety records, therefore, is due directly to the intensive educational safety drive we conducted, starting with 1925. Practically all of our accidents have been traced to carelessness, and carelessness can be overcome only by creating safety consciousness in the working force. We attribute a large part of the success of our efforts to the fact that the management took the initiative in the matter.

Method of Checking Drawings

Discussion

By Lucien I. Yeomans
Lucien I. Yeomans, Inc.

THE discussion on page 444, Vol. 70, of the *American Machinist* on the procedure for checking drawings, which is outlined on page 251, almost seems to warn against the modern, routine practice of checking drawings, and impels me to express some old fashioned ideas that have a bearing on the subject.

In common with every machinist who has worked in both large and small shops, and whose responsibilities have been such as to occasion varied contacts with the engineering and designing end of the business, I have noticed that the small shop with its one to a half dozen draftsmen has no trouble on account of incorrect drawings and errors. It is only when the drafting department becomes large enough to go into the division of labor which we understand to be "modern" that the shop finds the maximum of errors—and this in spite of the checkers that the small shop does without.

I have worked where one draftsman did everything, including the making of blueprints, and I have worked where the department included 150 men and was "organized" to the last notch. In the latter case the classification of the men was about as follows: General engineers, research engineers, designers layout men, detailers, tracers, checkers; named in the order in which work passed through their hands. Here was used the two color checking scheme on check blueprints made from the pencil drawing. Never have I seen so many expensive mistakes in design, in material selection, and in delineation, as in this shop. Another shop employing about 70 draftsmen, and with the labor divided about the same way, used to have a certainty of error in drawings sent the shop that made it necessary for the engineering department to keep an inspector in the shop all of the time, and the only thing he did was to make corrections on prints, when shown the errors, and then have the tracings corrected correspondingly later on.

It was at this shop that some alloy steel castings weighing a couple of tons each came in from a foundry a thousand miles away, with the cored holes about 2 in. larger than the 20 in. nickel steel shafts they were to go on. Here it was that an intermediate gear weighing 5,000 lb. was made of bronze and bushed with a bronze bushing.

My contention is that better work would always result if we returned to the old practice, where a draftsman was responsible for his own work, even to its tracing. I tried it in one company during the war, when we could do a great many things that were not in the book, and the results were most satisfactory. We had no tracers and no checkers, and the designers made crude general layouts which were worked up into group layouts, and the details were made by good all around draftsmen who traced and checked their own work.

It was fast—the fastest performance of the sort I have ever seen—and accurate to such an extent that I recall no actual loss being sustained on account of errors in drawings while this practice was followed.

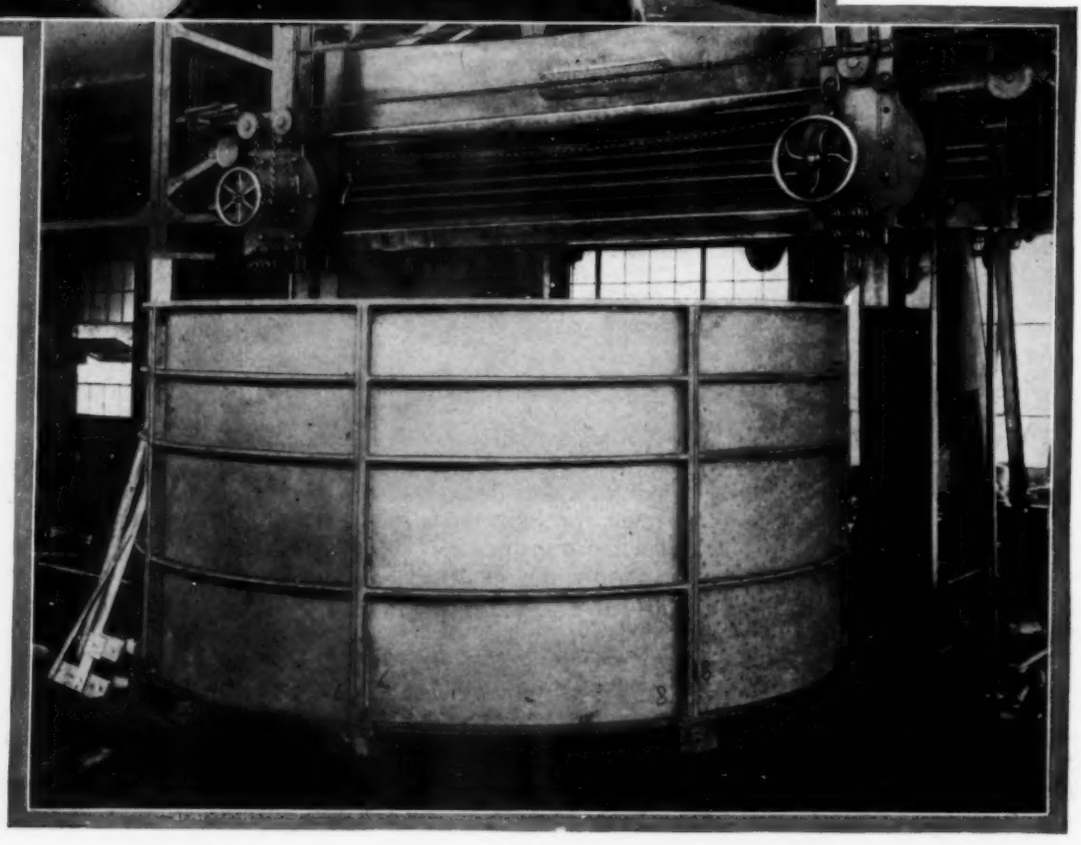
It is just as ridiculous to think that a good draftsman cannot check his own work properly as that a chemist cannot check his own analyses, or a mathematician cannot check his own computations, or a typist check her own work.

I do not expect everyone will agree with me, but I point out that in all such things there are two schools of egg handlers—One never puts all of the eggs in one basket, while the other does just that—but watches the basket.

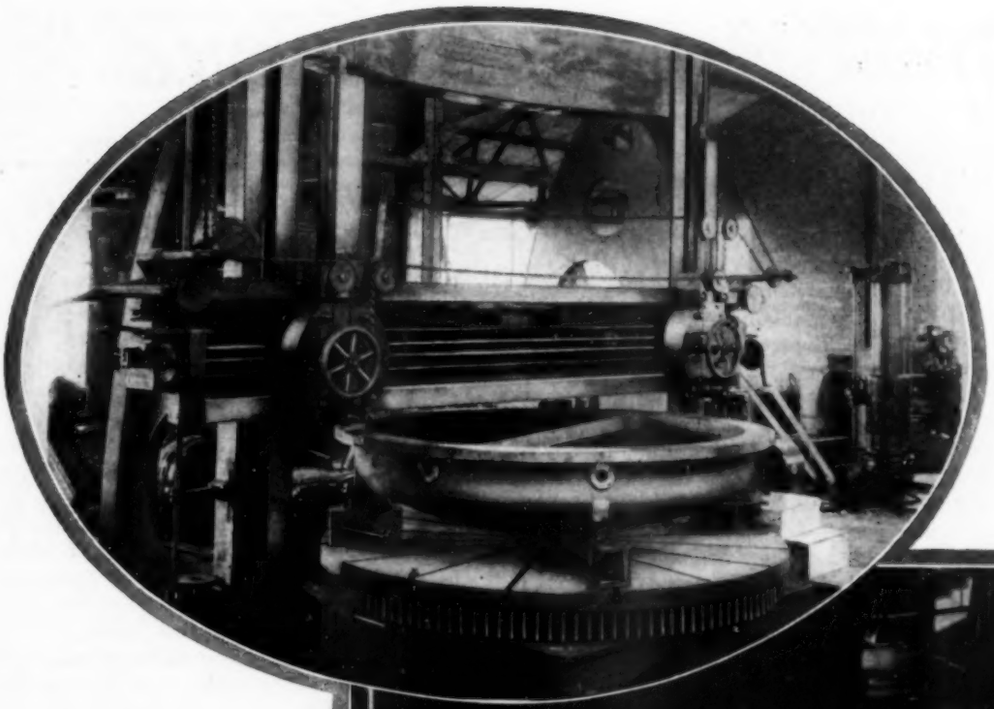
Heavy Work in a Southern Contract Shop

Photographs by courtesy of the Kingsport Foundry and Machine Company

A corner of a jobbing shop in the Tennesse Mountains where heavy castings are made to be delivered with machining completed. The shop employs 41 men in the foundry and 21 in the machine shop. The workmen are recruited in the mountains and trained locally under an apprenticeship system. The bridge crane serves both the foundry and large machines all of which are in one building to save time and transportation



The eight-piece digester tank shown on the boring mill below is required to be an excellent piece of work, without a scab or a blow hole. The thickness of the machined flanges is uniform throughout, showing high class molding and proper cooling. The iron is a semi-steel made by adding old locomotive springs to the mixture



Drilling the upper flange of an 11-ft. casting for a sugar evaporator. Another feature of the contract shop of this kind is that it will tackle difficult jobs that most plants will not take. The angular bosses on this casting were faced on a horizontal drill

The casting shown on the 16-ft. extension mill is the bottom of a 10-ft. soap kettle. Job work is procured from a radius as great as 300 miles from the shop

The sugar evaporator base shown below is 11 ft. 9 in. in diam. and 17 ft. across the points. It weighs 16,500 lb. To handle such a casting on a profitable basis in the small shop requires a high degree of skill and care

Standardization of Locomotive Parts in Germany

By George Hargrave

AT THE end of 1927 the German locomotive industry, like other branches of industry, organized its own technical standardization committee, called the General Locomotive Standards Committee. From the beginning this committee has worked in collaboration with the Railway Administration and the Industrial Standardization Committee. The work undertaken has been the standardization of locomotive parts for all gages, and for all locomotives whether state or privately built. The committee has been careful, however, not to attempt to standardize the locomotive as a whole.

The first step was to prepare and publish a list of "Uniform Locomotive Terms," and to fix a common designation of all parts. By this measure, ordering has been simplified and terms used are definite. The "Standard List of Drawing Sizes for Locomotives and Tenders," was next published, and after that came the standardization of individual and combined locomotive parts. So far approximately 500 separate standardization sheets have been published and others are in preparation.

The range of division of standardization is grouped as follows:

1. Basic Standards: Includes standards for tolerance and measurements, specification for bolts, nuts, pipe and all raw material.
2. Boiler Parts: This includes practically all sheet metal work, grate-bars, smoke stacks, and miscellaneous boiler equipment.
3. Small Parts: Such as cylinder cocks, water and other gages, and lubricators.
4. Frames and Mechanism: So far only buffer supports and axle bearings have been standardized.
5. Driving and Regulating Gear: Sheets have been prepared for piston rod diameters, driving rods, bearings and similar parts.
6. Water Tanks, Coal Bunkers, Engineman's Cab, and Exterior Decorations: So far the work on this group has been confined to hand rails, water-intakes, windows and boiler packing.

The introduction of all of this information into the shops has proceeded smoothly, although some changes in organization have been necessary. The drafting-room work has decreased, particularly the preliminary work.

Interchangeability of parts has made some headway, but has not been stressed as it would confuse the issue of standardization, but it is being extended to locomotives already in use, with the result that the shopping period has been considerably reduced.

Standardization does not appear to have eliminated competition among locomotive builders. Each firm still has the opportunity of demonstrating its ability over competition by a careful choice of type and the adaptation of construction details to the service the locomotive will have to perform, combined with careful execution of the work.

This standardization has been well received, and so far as observation goes, it seems to offer some advantage to both the manufacturer and purchaser, without retarding the design of new types and adaptations, and it should help where foreign competition is concerned for a time at least.

SEEN · AND · HEARD

By John R. Godfrey

The cost of belting—Scrapers for hard steel

WITH the increasing use of motor drives we are apt to think of belts as belonging to the past. But, as with so many other things, we are wrong if we do, for belts still play a very important part in the driving of machinery, even in very modern plants. Furthermore, some users are learning to take a lot better care of belts than ever before. And largely because they are keeping track of belt costs and belt repairs.

Just as a sort of eye-opener, let me quote a man well versed in costs in automobile plants. His figures show that in 1924 it took a round dollar, in belt cost alone, for each motor turned out. In 1928 this cost is given as 23 cents per motor, which is a remarkable saving. The figures, of course, include the belting used on all machines used in producing motors. They make a rather startling picture of the part that belts still play in modern shops and also indicate that detailed costs are being kept much more accurately than ever before.

Another motor shop reports that the cost of new belts have been reduced 50 per cent, and that repairs to belts cost 75 per cent less than they did a few years ago. This statement might be construed to mean that they were paying less for belts than formerly. In reality it means that first cost is not so important since, by selecting the best belts for the work, and taking care of them, the need for replacements has been greatly reduced. And this also shows more accurate records than formerly.

* * * *

THE new tungsten carbide cutting alloys are being tried out on many kinds of work. Slowly, of course, and not always successfully. But in most cases the users seem to agree that the failure is more the fault of the machine than the cutting tool. One shop manager was sure that the tools would save him money if he had machines rigid enough and with proper speeds and feeds. But he doubted the wisdom of using the new tools on his old machines and he didn't see his way clear to buy new ones, even if they were available.

He also voiced the opinion that it was not good policy on the part of some who are introducing the new tools, to advocate doubling the speed on even a very old machine, in order to utilize the new tools. Few machines, even if not very old, can stand double their present speed with satisfactory results.

Some of the machine builders are fooling themselves because the new cutting tools break down occasionally in a cut. The real reason for tool failure is that the machines do not hold the tool and work rigidly.

A special use of the new cutting metal was suggested recently in overhauling a machine with hardened gibs. The gibs had worn in spots and the fit of the slide varied at different points. "If that was only soft I could scrape it in without much trouble," said the repair man, "I can't very well grind it."

"Get a scraper with a tungsten-carbide tip," suggested a visitor.

Symposium on Welding Corrosion-Resistant Metals

Abstracts of papers presented at the annual meeting of the American Welding Society, held April 24-26 in New York

Welding Duriron

By Peirce D. Schenck
President, The Duriron Company, Inc.

THE successful welding of Duriron requires clear understanding of the characteristics of the metal, although it does not differ radically from the principles involved in welding gray iron. Duriron is really a silicide of iron—the composition being: 14.25 to 14.50 per cent silicon, 0.80 to 0.90 per cent carbon, 0.30 to 0.40 per cent manganese, and the balance iron.

The coefficient of expansion is considerably higher than ordinary gray iron. The ultimate tensile strength is about half that of gray iron, and the resistance to impact considerably less.

The care required in preheating depends very largely on the size and shape of the casting. Large parts having any considerable area require very careful preheating in order to maintain uniform expansion. Small cylindrical castings, such as pipe, can be heated quite rapidly without danger from cracking. In any case the part to be welded should be heated to about 600 deg. C., or a bright cherry red. The actual welding operation is very similar to the welding of other ferrous materials.

Practically all of the welding that has been done on Duriron has been with the oxy-acetylene torch. Duriron will not oxidize to any extent under the oxy-acetylene flame. It is very fluid when melted and a very sound weld can be produced. It is only necessary to exercise care to see that the edges of the part to be welded are thoroughly molten while filling in with metal from the welding rod. Duriron welding rod should always be used and is furnished of exactly the same composition as the castings. Excellent results have been obtained with the various fluxes used for cast iron welding.

Welding is largely used in the actual manufacture of Duriron equipment in the factory as well as for repair work and alterations to equipment in the field.

Occasionally castings which have lugs or other projections broken off in handling are salvaged by welding, but by far the greater part of the factory welding operations consists in building up continuous pipe coils or intricate fittings where joints would be objectionable. The welded metal is of the same thickness as the original walls of the pipe, it having been demonstrated that such a weld properly made is as strong or stronger than the original pipe and, in fact, a thicker pipe wall at the point of welding is objectionable due to unequal expansion and would tend to develop cracks under high temperature operation.

The pipes to be butt welded are placed in V-blocks or jigs to maintain alignment. Dry sand cores, if available, are inserted in the pipe at the weld point to prevent excess metal accumulating in the bore. After preheating, the beveled edges of the pipe are melted down to form the start of the weld and at the same time welding rod is melted in until the weld is equivalent to the wall thickness of the pipe. Surplus metal is wiped off with a wire brush or asbestos pad and, if carefully done, the weld will scarcely be perceptible.

Although there will be a difference in structure between the original pipe and the weld, the metallurgical composition of the weld and the structure are so close to the original casting that there is no difference in the acid resistance. If anything, the weld usually contains slightly denser metal than the original casting and is less affected by corrosion. The few welds that have failed in service have invariably shown signs of slag inclusions. Such slag inclusions can usually be detected by a careful welder and boiled out with a torch.

Welded Aluminum in the Chemical and Process Industries

By W. M. Dunlap
Research Bureau, Aluminum Company of America

IN CONSIDERING resistance to corrosion and chemical action, it is necessary to take account of the purity of the aluminum. In general, the higher the purity of the metal the greater is the resistance to corrosion, especially in acid media. In the literature relative to the corrosion of aluminum, occasional reference is made to failure of aluminum chemical apparatus due to chemical attack at the welded joints. This difficulty can be corrected, in part, by proper care in making welds. The metal in the weld is analogous to a casting and there is a tendency toward a difference in solution potential between the wrought material and the cast material, which would cause electrolytic corrosion. It is sometimes possible to hammer the weld and the adjacent metal and thus produce a more nearly uniform condition throughout the apparatus. But even where this is not possible, careful workmanship in making and finishing the weld is effective in overcoming much of the difficulty which might otherwise be experienced.

A series of commercially pure aluminum specimens welded with commercially pure wire and 5 per cent silicon alloy wire was subjected to the corrosive action of a spray of 20 per cent salt solution for a period of six months. A similar series of specimens was subjected to hard tap water corrosion for a period of 45 weeks. A visual examination of the corroded specimens indicated that there was no appreciable difference in resistance to corrosion between welds made with commercially pure wire and 5 per cent silicon alloy wire.

When aluminum is subject to corrosive reagents it is desirable that there shall be as little tendency toward

electrolytic corrosion as possible. No other metal should be in contact with the aluminum and with the corrosive agent. If another metal is used, it should be insulated from the aluminum by some non-conducting material.

Some tests were made for the purpose of comparing the strength of welded commercially pure aluminum pipe with the strength of the original unwelded material. Test samples were prepared from annealed 2S (commercially pure aluminum) and annealed 3S (commercially pure aluminum plus 1.25 per cent manganese) in ¾ in., 1 in., and 1¼in. iron pipe size. The test samples were cut in half and then welded together, the ends to be welded together being first chamfered and nicked in the usual manner. Commercially pure welding wire was used for all welds. The welds were not dressed, but left as made by the torch, slightly built up.

All samples were subjected to tensile and hydrostatic tests. For hydrostatic tests, the ends of the tubes were threaded and one end capped while the other end was connected to a high-pressure hand pump, using iron fittings. In the tensile tests, the stress was applied in a direction perpendicular to the welded joint, thus tending to pull the weld apart. In the hydrostatic tests, the major stresses, which again are in tension, are applied in the direction of the welded joint. In this test there is also a secondary tensile stress applied in a direction perpendicular to the welded joint, about half as great as the primary stress,

From the tensile tests it was found that there is practically no difference between the tensile strength of the welded tubes and the original tubes. Moreover, only two out of a total of eighteen welded samples failed in the welds. This would indicate that the weld is actually stronger than the original tube, and it is reasonable to expect this, since the tube wall is somewhat heavier at the weld due to the building up of metal in the process of welding. Furthermore, the tubes were in the soft or annealed condition.

The hydrostatic tests also indicated that the welded and original samples have practically the same strength. In these tests in every case the pipe burst between the weld and one end of the sample. This again indicates that the weld is stronger than the original sample. The original tubing used in these tests was dead soft, or very nearly so, and that the above discussion would, of course, not hold for intermediate or hard temper tubing. Even where hard tempered tubing is used it would seem that the strength would, in most cases, be governed by the strength of the tube immediately adjacent to the welded joints where the material becomes annealed from the heat of welding, making the results of these tests applicable within reasonable limits.

The Production of Ductile Welds in Nickel and Monel Metal

By N. B. Pilling and T. E. Kihlgren
The International Nickel Company

A CONSIDERABLE advance has been made in methods for welding nickel and its principal commercial alloy, monel metal, within the last 10 years. While it is true that these metals are not as easily handled as steel and other metals, such difficulties as have been experienced are now largely under control. The success of welds made with these two metals is highly dependent upon details of welding method, and the key to the production of good welds lies in the deposition of metal that is metallurgically sound.

In fusion welding, the very nature of the operation requires a high rate of energy input at the weld in order to confine the fusion locally and this unavoidably results in superheating the melted metal and exposing it under highly unfavorable conditions to reaction with the surrounding atmosphere. The normal result of such exposure is the loss by oxidation of the necessary auxiliary elements, followed by the absorption of certain gases and development of porosity on freezing. The degree to which this occurs depends to a very considerable extent upon the method and circumstances of fusion.

Protective Atmosphere Essential

With the metallic method of welding, in which the filler wire also serves as one of the arc electrodes, the superheating of the fused metal, particularly that forming the arc crater on the wire, is so great that the chemical reactivity between metal and atmopshere is intense, and the content of magnesium, small though it is, may pass off by distillation. Arc welds made in the open air without a protective atmosphere are almost certain to be highly porous and exceedingly brittle. A protective atmosphere is an essential requirement for the production of sound arc welds, and one way of conveniently achieving this by the use of a suitable coating on the electrode wire. A good coating of this sort involves the use of a powdered magnesium-manganese-silicon alloy, and operates on the theory of supplying additional magnesium to the fused metal to make up for that lost. A more recent development along this line employs a coating material containing titanium and calcium as active ingredients. The calcium being highly volatile at arc temperature, forms a harmles vapor jacket displacing air from around the arc, while the titanium, resisting vaporization, persists as a highly reducing element in the fusion protecting it from oxidation.

In carbon-arc welding, since the filler wire no longer acts as one electrode of the arc, the metal droplet does not reach the extremely high temperature that it does in the metallic arc. It is probable, therefore, that the very marked superiority of carbon arc welds of nickel and monel metal shown in tests is due to this colder operation, rather than to the change in arc atmosphere. It is highly necessary to coat the filler wire, and the titanium-calcium mixture has been found excellent.

In welding with the oxyacetylene torch, a difficult condition arises from the extremely oxidizing condition of certain portions of the oxyacetylene flame. Fluxes, when used, are apt to be over-active and by continually removing the oxide crust allow the oxidation of magnesium and other elements to proceed so far that metallurgical difficulty is encountered. This is particularly the case with nickel, and at times even short welds have cracked apart spontaneously on cooling. Over-fluxing also increases the liability toward gas precipitation and porosity in the finished weld. A good oxyacetylene weld in either nickel or monel should freeze quietly at the end of the seam leaving a broad, shallow pipe or depression. Any display of sparks or volcanics indicates unsoundness.

By directing the torch flame so that the expended gases bathe the recently deposited metal the freezing of the weld metal is delayed and its soundness improved considerably.

While delaying the rate of freezing is helpful, we have found another more convenient way of improving

the soundness, consisting in imparting a mild but controlled fluxing action to the flame itself, accomplished by introducing a gaseous boron compound, into the acetylene supply. Fluxing by this means has the obvious advantages that the flux follows the flame, is always present where most needed and is subject to close control. With both nickel and monel it was possible to make the weld at a faster rate with the borated flame than with the ordinary flame, owing to the somewhat easier flowing quality which the flame imparted.

Borating the acetylene supply can be done by bubbling the gas through a solution of the boron compound. This solution can be made by dissolving finely powdered boric oxide or fused boric acid in denatured grain (ethyl) alcohol.

Both nickel and monel metal are fragile at a temperature just below their freezing points and if put under stress at this temperature will easily break. When a welded seam is remelted, as in building up or reseaming the weld, a crack may form down the center of the weld passing entirely through the seam. This occurs because at the edge of the plate where the fusion is begun the entire tensile load due to the thermal expansion of the plate metal is borne by the freshly solidified metal, and once a crack forms it is self-propagating, following the torch closely. If the simple precaution is observed, never to start refusion at an exposed edge, but leave an inch or two of cold metal to bear the thermal stress, freedom from this kind of cracking is assured. Cracking may also develop, even on the first seam, if the weld is overfluxed.

Welding in Aircraft Construction

By Richard M. Mock
Aeronautical Engineer, Bellanca Aircraft Corporation

THOUGH welded fuselage structures have been standard practice for the past few years, welding was retarded by the lack of knowledge of the subject on the part of the aircraft designer. Of late, numerous tests have been run by various agencies on the strength of welded structures. This increased knowledge of welding has resulted in an increased use of welded parts. Welded steel control surfaces are now almost standard on all American airplanes and though the majority of wings are still constructed of wood there is an increasing tendency toward metal, both duralumin and welded steel. Fittings of duralumin and steel are used in about equal quantities. Heat-treatment facilities have aided greatly in the use of both duralumin and steel construction and now heat-treated welded parts are common practice.

Exceptionally light gages are used in aircraft construction, and if care is not taken, one piece of metal will be burned before the other has reached the proper temperature for fusion. Edge welds should be avoided and provision should be made so that welds may be made away from the heavy members toward the lighter ones. When very light-gage material is employed welds should be made from one side only. In addition, care must be taken that the members will cool without causing undue internal stresses. This often causes cracking in a light gage member when it is one of a number that form a cluster of tubes, or it is welded to a much heavier member. As the tubes cool after welding, there is a certain amount of annealing adjacent to the weld. If the design of the joint is such that there is a complete circle of weld around the tube, and there is a bending stress in the member, it will undoubtedly fail in this annealed portion. A complete circle of weld usually may be eliminated by producing a "scraff" or "fish mouth" effect which in addition gives a slightly longer weld. Though this slightly increases the cost of production, the resulting increase in strength is more than compensated. Of course, in all our simple tubular columns we have a circle of weld at the ends and for this reason we never employ a coefficient of fixity of more than two when using any of the column formulas. When members are continuous through a joint, they are calculated as two separate members meeting at the joint.

In the design of welded joints it is nearly always possible to eliminate welds in tension and place them in shear. Failures have been known when tension welds have pulled out completely by tearing in the annealed portion.

The ends of members should be simple so that they may be prepared cheaply. Odd curves, slots, fish mouths, all tend to increase cost. In addition, the welds should not be exceptionally long. Provision should also be made so that the truss will fit a jig without too much complication.

Until recently practically all aircraft fittings were of welded construction. Now there is a great tendency toward forgings and high strength aluminum alloy castings. These parts are usually developed by first building up a welded fitting and later substituting the forging or casting. However, a considerable number of highly stressed parts are being welded and heat-treated or normalized later.

In addition to welding in steel, a great deal of aluminum welding is done. This is especially on gasoline and oil tanks. Tanks of both aluminum and duralumin are riveted and then the seams and rivet holes welded over. Fittings for plumbing to the tanks are also welded in place. Other aluminum welding is done, to a slight extent, on cowlings and fairings.

Chrome-molybdenum steels commonly used in aircraft construction have certain air hardening properties, which make them highly desirable for welding. Light-gage parts may often be worked in the annealed state and then welded with the rapid air cooling resulting in a certain amount of heat treatment.

Welding Chrome-Molybdenum Members

For welding chrome-molybdenum members, Swedish iron welding rod has proved the most satisfactory. When members are to be heat treated after welding, there has been a tendency toward the use of rod of the same material as the parts to be welded in order to give a more homogenous unit after heat treatment. We have found by actual test that an excellent joint, though somewhat more difficult to weld, can be obtained. This applies only to parts for heat treatments. Some authorities state that they have tested joints using chrome-molybdenum rod and have had consistently high values and then found one member with strength about one-quarter of the rest. This might be attributed to the difficulty of welding.

Occasionally in parts where repeated stresses occur, such as in engine mountings, it is desirable to have more bulky material for the same strength, and here 1020 carbon steels are sometimes employed. However, chrome-molybdenum steel would give a still higher strength for the same weight and there would not be the possibility of a workman mistaking carbon steel tubing for chrome-molybdenum which might result in

disaster. For this reason only chrome-molybdenum tubing is kept in most shops. However, for fittings, which are usually built up from sheet stock, carbon steel is sometimes desirable where intricate bends are necessary and continued reheating employed.

Nickel steel is used almost exclusively in bolts and exceptionally highly stressed members. Though welding of nickel steels is prohibited, we have found that a highly skilled welder can weld nickel steel quite successfully. However, the human element is too great and welding of nickel steel poor practice.

One other welded material that is used in limited quantities in airplanes is Stellite. Tail skid shoes receive considerable abrasion and, though of manganese steel, are usually finished with a $\frac{1}{8}$-in. layer of Stellite, welded to the bottom.

The Best Defense Against Communists—*Discussion*

By William E. Kerrish

IT HAS been rightly pointed out that the equitable distribution of the fruits of human labor is one of the major social and economic problems of the day. This problem is closely allied to the understanding which the employer has of the basic human rights of the employee, and the understanding which the worker has with regard to his obligations to his employer, to industry, and to society.

Obviously, the relationships which exist between capital and labor have a very direct bearing upon the success or the failure of the propaganda of the communist and the professional labor agitator. If these human relationships were everywhere ideal then the communist would not get even a hearing, much less a foothold. In many industries and commercial establishments the existing relations between capital and labor are so nearly ideal that the communist finds the soil a barren one to his subversive and destructive doctrine. Elsewhere it is otherwise, and these points represent the weak links in the chain of our industrial peace and stability.

The workers of America as a whole have not been bitten by the communist bug, and for very good reasons. When the American workman or artisan compares his political and economic status with that of the workers of other lands, he finds he has reason to say from the bottom of his heart, "Give me the good old U.S.A." Moreover, the inherent common sense of a people living under representative governmental institutions results in an instinctive knowledge that the communist has nothing constructive to offer in the solution of the intricate problems of social justice in a highly specialized industrial age.

For these obvious reasons and for others not so obvious, the Communist Internationale, with headquarters in Moscow, is having a mighty hard time alienating the workers of America from their natural loyalty to the principle of the right of men to private property, and to the individual control of wealth justly earned or acquired, for this principle is written into the very soul of our country. It is responsible in large measure for our healthy progress in all the arts of peace. It is this right of private property which the communist attacks; but this attack is only the entering wedge to a philosopy which if applied would spell the doom of our institutions.

While these things are true, there is no reason for immediate alarm that communism will capture America, either politically or economically. But there is good reason that we should be on our guard with regard to its subversive activities, recalling that eternal vigilance is the price of liberty.

The chief of the political bureau of the Communist Internationale has given its agents in the United States definite orders to "work into the trade unions." This command to undermine the ranks of organized labor in America and bring it under the sway of Moscow has been hard to carry into effect, but here and there success has crowned the communist effort. This condition is well known to the president of the American Federation of Labor and he has declared the stand of his organization as opposed to such propaganda in no uncertain terms.

By the test of American principles the interests of capital and labor are in reality one. According to the communist, the bolshevist and the socialist there is between them a war to the death. By the test of American principles both capital and labor have rights and obligations to each other and to society, but the communist says that capital is unnecessary and therefore has no rights whatsoever.

The attack of the communist is directed at the fundamental human right of men to life, liberty and the pursuit of happiness. This intrinsic right, no government gave. But just government exists for the protection of the citizen in the lawful exercise of this right. Applied to industrial relations it means that the workman is entitled to a living wage. As far as economic conditions will permit, he has a right to ask for a financial return for his work which will permit him to support his family in reasonable comfort, and in a manner fitting the dignity of human nature, as well as to set aside something for his old age. The workman has the obligation to give the best that is in him to his employer. Even in his attitude of mind toward the rightful exercise of the just authority of his employer and his properly accredited representative, the workman should apply the principle of justice and recognize that the authority of the employer is delegated to him, not as an individual but as one who holds a position of responsibility in industry, and through industry to the nation.

Likewise capital has a definite obligation to the human element in industry which gives its energy and abilities to the building up of the nation's industrial life. It must realize that the workman is more than a mechanical part of the economic system, that he is a human being with emotions, ambitions and inalienable rights. It is as such that the employer should consider him. To look upon the workman merely as a cog in the vast industrial machine is, in the last analysis, fatal to economic stability and peace.

Thus is education Americanism's answer to the communist, education in sound moral principles. As Washington declared in his farewell address, "Reason and experience forbid us to believe that national morality can long prevail where religious principles are excluded." These principles rightly understood by both capital and labor and diligently applied to the social and industrial structure are the only effective answer to the communist.

IDEAS · FROM · PRACTICAL · MEN

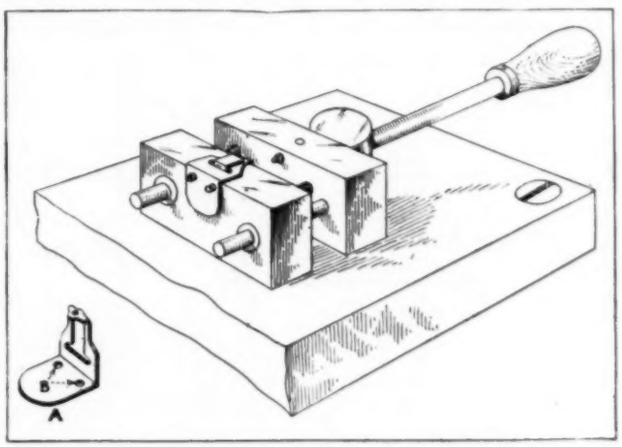
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

A Simple Punching Tool

By Charles H. Willey

Asst. Plant Supt. Hoyt Electrical Works

The sketch shows a very simple tool for punching a hole in $\frac{1}{32}$-in. brass. The hole is for jewel screws and is to be tapped 80 threads per in. The tool is operated by an eccentric, the punch holder being guided by pins sliding in hardened bushings in the die-shoe. Since the holes must be punched after the part has been bent,



Tool for punching small holes in thin stock for meter parts

as shown at *A*, the piece is located by two small pins in the side of the die-shoe fitting the holes *B*.

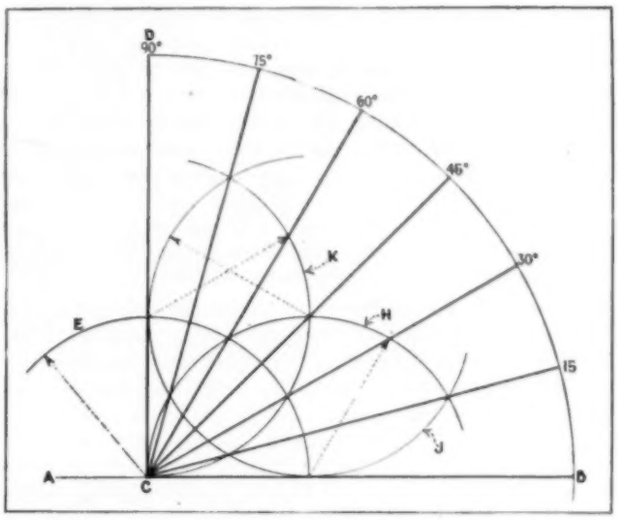
After the hole has been punched, the lever is pushed away from the operator and the punch is withdrawn by stiff springs between the punch holder and the die-shoe. This tool has punched more than 200,000 holes at a piece-work rate of four cents per 100 holes.

Laying Out Angles Without a Protractor

By J. Staveley

Sometimes it is necessary to lay out angles when no protractor is at hand. Angles can be laid out by the use of a square, a pair of dividers and a straight-edge in the following manner:

Draw the horizontal line *A-B* and the perpendicular line *C-D*. With the dividers set to any convenient radius, draw the arcs *E*, *H*, *J* and *K* from the centers shown in the illustration. Lines drawn from the intersection of lines *A-B* and *C-D*, through the intersections of arcs *H* and *J* (outer), *E* and *K*, *E* and *H*, and *H* and *J* (inner), will be 15, 30, 45, 60, and 75 deg., respectively, from the horizontal. The drawing of the perpendicular line forms an angle of 90 deg., automatically. Other and intermediate angles can be laid out by subdividing those already obtained.



Method of laying out angles without a protractor

Keeping Records of Obsolete Cams

By C. W. Hinman

Chief Tool Designer, Addressograph Comp

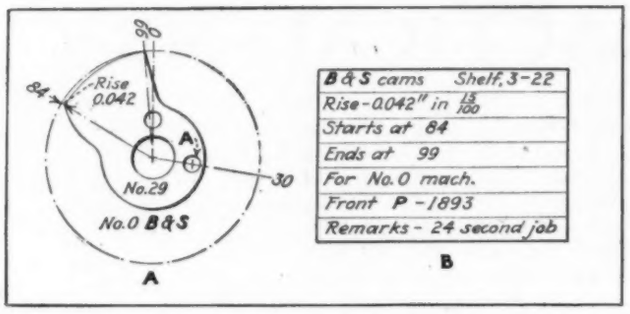
An easy and inexpensive way to save time and expense in the automatic screw machine department is to avoid making cams unnecessarily. Two simple methods of keeping track of obsolete cams are shown in the illustration, and explained below, for the benefit of anyone who has not started such a system.

Make up three loose-leaf books having leaves of any convenient commercial size. Label one book, No. 0, one, No. 00, and the other "No. 2 B & S Screw Machine Cams." Use one page to a cam.

Gather up all the obsolete and scrapped cams. Lay one on a page, with the "zero" hole up, and scribe around its outside and around the inside of the holes with a sharp pointed pencil. Show the degree markings along the circumference where the lobe starts and ends, and also the rise and dwell, if any. Also designate the section and shelf number in the tool vault where it can be found.

When making new sets of cams, refer to these books, and very often you will locate just the cam you want, or one that can be used with a slight change.

Another method is to make a single drawer card file, for all the cams used in the department. This file can carry descriptions of both live and obsolete cams and each card should carry the information shown at *B* in



Sample entry in loose-leaf or card record

the illustration. Make a separate file for each size of machine and file the cards numerically according to the rise on the cam, having the lowest rise in front.

For "pick up" jobs, having small quantities, and for jobbing work it is hardly ever necessary to make new cams when this method of filing is used. Sometimes, drilling a new hole in a cam will enable it to be used. When this is done, a note should be made of it, such as: "Lobe starts at 54 from hole *A*."

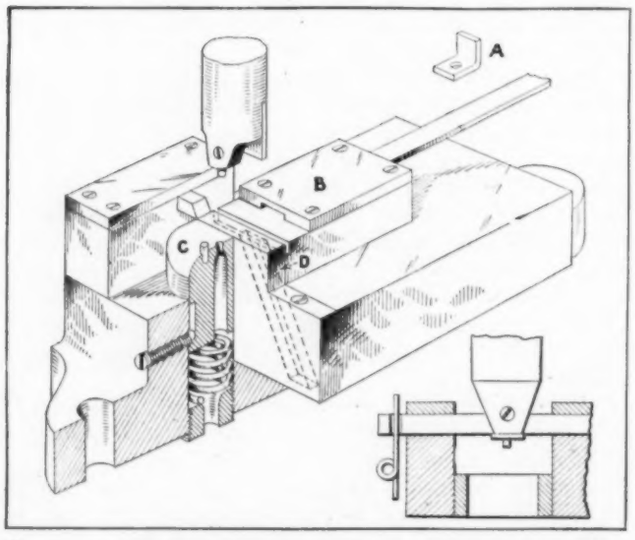
From such records we have frequently selected a whole set of cams, for a low production job. Possibly 3 or 4 seconds may have been lost on each piece made, but on such a job this loss is more than offset by saving the cost of a new set of cams.

Combination Piercing, Shearing and Bending Tools

By Charles H. Willey

The part shown at *A* is used in large quantities as a fastener for glass in the frames in one of our products. At first we made it in two operations, punching and bending. As is well known, when it comes to picking up pieces 0.14x$\frac{1}{2}$x0.025 in. and placing them on the pin of a bending die—up goes the cost of that item.

When we got to using several thousand of the pieces per week, the tools shown in the illustration were made. The stock, soft brass, is fed from a roll through the guide *B* and up against the stop pin *C*. When the ram descends, the hole is pierced and then the shear blade starts to cut. By the time the shear blade has cut off the piece, the punch holder has come into contact with the die, which starts to descend, bending the piece over the anvil *D*. When the ram comes up, springs force out the strippers, which strip the piece from the punch. The spring under the die is, of course, stiff enough to hold the die while the 0.0635-in. hole is being pierced, yet it descends when the punch holder comes into contact with it.



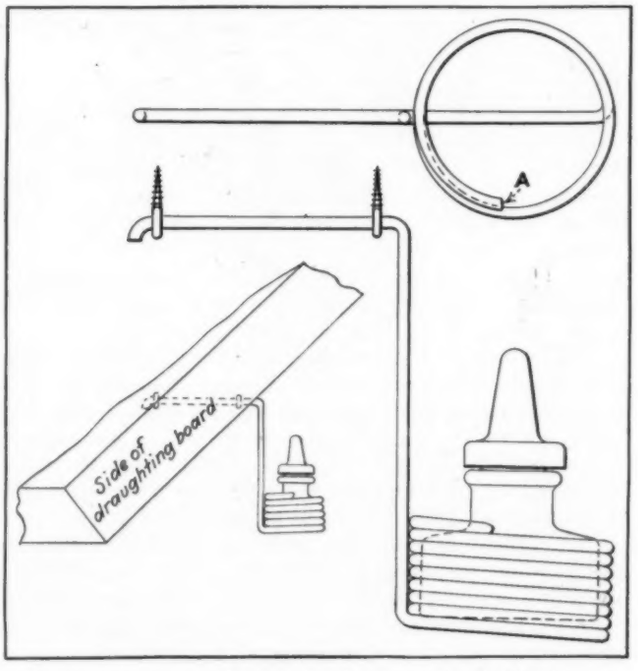
Combination press tools for a small part

Production with these tools is 1,200 pieces per hour at a piece-work rate of 5 cents per 100 pieces. When the pieces were made in two operations, the rate was 12 cents, besides having to use two presses, one for each operation.

An Ink Bottle Holder

By S. C. Mundy

This ink bottle holder for attachment to the drawing board is very easily constructed and possesses some advantages over the stationary type, which can only be used on a flat surface. Being hinged on the under surface of the board and free to swing it is adapted for use with drawing boards that are used in a slanting position. It is always handy, close to the work, and should the holder become jarred or struck the ink is not so liable to splash out of the bottle as with a stationary holder.



An arrangement that maintains an ink bottle in an upright position regardless of the inclination of the drafting table

The holder is constructed of No. 10 or 12 gage iron wire, depending upon its stiffness. It can be wound by hand, or, if a number of holders are to be made, a simple wooden arbor with a slot in one end and mounted in a lathe will facilitate the work. The beginning of the first turn at the top of the holder is bent slightly toward the center as shown at *A* so that when the bottle is pushed down into the holder the end of the wire will spring back and prevent the bottle from falling out. After the last turn is wound the wire is brought straight across the bottom of the holder to serve as a support for the bottle, and then bent up along the side as shown.

Feed and Speed Tables for Milling Cutters

The following steps illustrate a typical use for Tables I, II and III:

1. Decide on desired surface speed of cutter in feet per minute.
2. Decide on size of cutter.
3. From Table I obtain speed of cutter in r.p.m.
4. From Table II obtain the corresponding value of "teeth per minute."
5. From Table III obtain the corresponding value of "table travel per tooth." If this value is too small or too large, new values of surface speed, size of cutter, number of teeth in cutter or table feed must be assumed, and a new trial made.

For example, suppose that a 5-in. cutter and 100 feet per minute surface speed are assumed as the starting point. From Table I the nearest value of cutter speed is 81 revolutions per minute. Suppose the cutter has 20 teeth. Then, from Table II, the "teeth per minute" value is 1620. From Table III, if the table feed is 4 in. per minute, the corresponding value of the table feed per tooth is 0.002 inch.

To be concluded on sheet 20a

Table I—Surface Speed of Milling Cutters in Feet per Minute

Dia. of Cutter	Revolutions Per Minute: 15	18	26	32	38	47	56	67	81	100	120	134	168	200	245	300	360	Dia. of Cutter
0.50	2	2.5	3.5	4	5	6	7.5	9	10.5	13	15.5	17.5	22	26	32	39	47	0.50
0.75	3	3.5	5	6	7	9	10.5	12.5	15.5	19	22.5	25.5	32	38	46.5	57	68.5	0.75
1.00	4	5	7	8	10	12	15	18	21	26	31	35	44	52	64	78	94	1.00
1.50	6	7	10	11.5	14.5	18.5	22	26	31.5	39	45	52.5	65.5	78	95	117	140.5	1.50
2.00	8	10	14	16	20	24	30	36	42	52	62	70	88	104	128	156	188	2.00
2.50	10	13	17	21	25	31	36.5	44	52.5	65	78	87	109	130	159	195	234	2.50
3.00	12	15	21	25	30	36	45	54	63	78	93	105	132	166	192	234	282	3.00
3.50	13.5	16.5	23.5	29	34.5	42.5	51	61	74	91	109	122	154	182	223	273	327	3.50
4.00	15.5	19	27	33.5	39.5	49	58	69.5	84	104	125	139.5	174.5	208	255	312	374.5	4.00
4.50	17.5	21	30.5	38	45	55.5	66	79	95.5	118	141.5	158	198	236	289	354	425	4.50
5.00	19.5	23.5	34	42	50	61.5	73.5	88	106	131	157	176.5	220	262	321	393	471.5	5.00
5.50	21.5	26	37.5	46	55	67.5	80.5	96.5	116.5	144	173	193	242	288	353	432	.....	5.50
6.00	23.5	30	41	50	59.5	74	88	105	127	157	188.5	210.5	264	314	384.5	471	.....	6.00
7.00	27.5	33	47.5	58.5	69.5	86	102.5	122.5	148	183	219.5	245	307.5	366	448	.....	.....	7.00
8.00	31.5	37.5	54.5	67	79.5	98	117	140	169.5	209	251	280	351	418	.....	.....	.....	8.00
9.00	35.5	42.5	61	75.5	89.5	110.5	132	158	191	235.5	282.5	315.5	396	471	.....	.....	.....	9.00
10.00	39.5	47	68	84	99.5	123	146.5	175.5	212	262	314	351	440	.....	.....	.....	.....	10.00

Feet Per Minute

Table II—Speed of Milling Cutters in Teeth per Minute

Teeth in Cutter	Revolutions Per Minute: 15	18	26	32	38	47	56	67	81	100	120	134	168	200	245	300	360	Teeth in Cutter
5	75	90	130	160	190	235	280	335	405	500	600	670	840	1000	1225	1500	1800	5
6	90	108	156	192	228	282	336	402	486	600	720	804	1008	1200	1470	1800	2160	6
7	105	126	182	224	266	329	392	469	567	700	840	938	1176	1400	1715	2100	2520	7
8	120	144	208	256	304	376	448	536	648	800	960	1072	1344	1600	1960	2400	2880	8
9	135	162	234	288	342	423	504	603	729	900	1080	1206	1512	1800	2205	2700	3240	9
10	150	180	260	320	380	470	560	670	810	1000	1200	1340	1680	2000	2450	3000	3600	10
11	165	198	286	352	418	517	616	737	891	1100	1320	1474	1848	2200	2695	3300	3960	11
12	180	216	312	384	456	564	672	804	972	1200	1440	1608	2016	2400	2940	3600	4320	12
13	195	234	338	416	494	611	728	871	1053	1300	1560	1742	2184	2600	3185	3900	4680	13
14	210	252	364	448	532	658	784	938	1134	1400	1680	1876	2352	2800	3430	4200	5040	14
15	225	270	390	480	570	705	840	1005	1215	1500	1800	2010	2520	3000	3675	4500	5400	15
16	240	288	416	512	608	752	896	1072	1296	1600	1920	2144	2688	3200	3920	4800	5760	16
17	255	306	442	544	646	799	952	1139	1377	1700	2040	2278	2856	3400	4165	5100	6120	17
18	270	324	468	576	684	846	1008	1206	1458	1800	2160	2412	3024	3600	4410	5400	6480	18
19	285	342	494	608	722	893	1064	1273	1539	1900	2280	2546	3192	3800	4655	5700	6840	19
20	300	360	520	640	760	940	1120	1340	1620	2000	2400	2680	3360	4000	4900	6000	7200	20
21	315	378	546	672	898	987	1176	1407	1701	2100	2520	2814	3528	4200	5145	6300	7560	21
22	330	396	572	704	836	1034	1232	1474	1782	2200	2640	2948	3696	4400	5390	6600	7920	22
23	345	414	598	736	874	1081	1288	1541	1863	2300	2760	3082	3864	4600	5635	6900	8280	23
24	360	432	624	768	912	1128	1344	1608	1944	2400	2880	3216	4032	4800	5880	7200	8640	24
25	375	450	650	800	950	1175	1400	1675	2025	2500	3000	3350	4200	5000	6125	7500	9000	25
26	390	468	676	832	988	1222	1456	1742	2106	2600	3120	3484	4368	5200	6370	7800	9360	26
27	405	486	702	864	1026	1269	1512	1809	2187	2700	3240	3618	4536	5400	6615	8100	9720	27
28	420	504	728	896	1064	1316	1568	1876	2268	2800	3360	3752	4704	5600	6860	8400	10080	28
29	435	522	754	928	1102	1363	1624	1943	2349	2900	3480	3886	4872	5800	7105	8700	10440	29
30	450	540	780	960	1140	1410	1680	2010	2430	3000	3600	4020	5040	6000	7350	9000	10800	30

Teeth Per Minute

Submitted by R. L. Pelland, Vandercook & Sons

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

A Matter of Balance

A STUDY of the business situation both in the United States and in Europe leads to the conclusion that most countries are traveling in more or less well-defined economic circles, but at widely differing levels, or at various rates of speed, as you choose to look at it. Viewed in this light, the prosperity that has existed in the United States for many months means simply that this country is on a higher level, or moving at a greater speed, than are other countries.

What interests us here, and our friends across the Atlantic as well, is how long we can maintain the present condition. Of the several factors involved in the maintenance of industrial activity, which one is going to vary first and thus throw the situation out of balance? After all, the whole thing is a question of balance, and very nice balance at that. So long as we keep it there is no danger of a depression.

To many observers in this country the most important factor in prosperity is the spirit of co-operation between employer and employee, and the carrying out of it in practice. At the same time, it is the factor least understood abroad, and therefore probably the real secret of the difference in levels between American and European economic conditions.

Such being the case let us do everything possible to foster the co-operative spirit. Let us hope, also, that European industry and trade will soon discover the great advantages of co-operation over industrial strife and mutual suspicion.

Inconsistencies of the Age Limit

THERE are serious inconsistencies in the arguments of those who seek an alibi for the low age limit at which men are banned from employment in some localities. The plea that only young men can stand the pace of modern production overlooks the fact that modern machine equipment is taking over more and more of the manual labor formerly done by the operator. In many cases the operator's only work is to put a piece in a chuck and remove it when completed, even the tightening of the chuck being done by power. The actual manual labor to be expended is less than ever, and the period of a man's usefulness should therefore be lengthened rather than shortened.

We are confronted with the widely proclaimed shortage of skilled men on the one hand, and on the other with the proposal to reduce deliberately the years through which the skill acquired by expensive training may remain available. Although modern medical science and sanitation have increased the average life of mankind it is proposed to shorten the period during which it may be usefully employed.

It might also be well to consider the effect of such a practice on the recruiting of the working force of modern industry. Unless the same practice extends to all industries those with the more liberal policies are likely to have the first choice of desirable young men. For, while every one may hope to have a competency before reaching the dead line, he will hardly look with complacency on the prospect of being discarded at fifty.

Maintaining Quality in an Old Plant

QUALITY as applied to manufacture is much more easily discussed, or claimed, than proved. The term may be based on materials, on accuracy, on the fit of parts, or on the finish, but its existence is difficult to prove except through the satisfaction the product gives in actual service. Quality is considered as synonomous with cost, frequently without justification.

Men often get the idea that quality can only be obtained by the use of certain methods with which they are familiar, and are prone to reject the product of any other methods as inferior, especially when the other methods are introduced by newcomers in the organization. The fallacy of this belief has been shown in many shops where new management takes charge of an old institution with a good reputation. It is very difficult for the older men of the former organization to believe that the new product can be as good as the old if the methods are changed.

There are instances, however, where this has not been the case. Tactful handling of the situation, which secured the co-operation of the older men, has resulted not only in an acknowledgment of the high quality of the new product but an enthusiastic support of the methods and the results obtained. The manager who can go into an old plant and win over the men who have helped to build it up fully deserves his title.

· SHOP · EQUIPMENT · NEWS ·

Thomson Power Miter Welder

DEVELOPED especially for making T-welds or welds at an angle which might be termed miter welds, this power-driven butt welder made by the Thomson Electric Welding Company, Lynn, Mass., is particularly suitable for plants manufacturing window sash. The same machine may also be equipped with clamps for handling flat strip stock not over 4 in. in width, and for round or tubular members having a cross-section not exceeding ½ sq.in. approximately. Figs. 1 and 2 show front and rear views of the machine.

As can be seen in Fig. 1, drive to the machine is by motor through a belt to a worm reduction unit actuating a cam shaft. The work clamps are air-operated and are controlled by a foot valve. The transformer is rated at 60 kva. and is completely protected from flash. Round side rods sliding in bearings at the right and left ends of the frame carry the moving platen, and the bearings for these side rods also are protected from flash and provided with suitable lubrication.

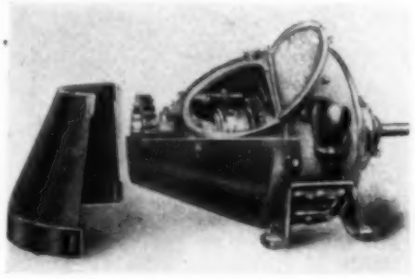
Various types of clamps for different classes of work may be supplied and can be arranged to operate in unison or independently of one another, as may be required. Similarly the return of the moving platen to open or loading position may be obtained either by hand or automatically through the release of the clamps. The welding speed or cycle may be varied from ten to twenty cycles per minute, depending upon the cross-section of the work to be handled.

The unit weighs from 3,000 to 3,500 lb. depending upon the type of clamp supplied.

Westinghouse Type SK Totally-Inclosed Fan-Cooled Motor

A totally-inclosed, fan-cooled motor of the SK type, for d.c. applications, has been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. All mechanical parts, with the exception of the shaft, are interchangeable with those parts used on the present totally-inclosed, standard-type SK motor of the same frame size. The essential mounting dimensions, likewise, are the same as on the standard, open-type SK motor of the same frame size.

Bracket openings are inclosed with solid, flat inclosing covers and gaskets. The use of sealed sleeve bearings is thus permitted, and the motor is protected from dust and fumes. The commutator end of the motor is

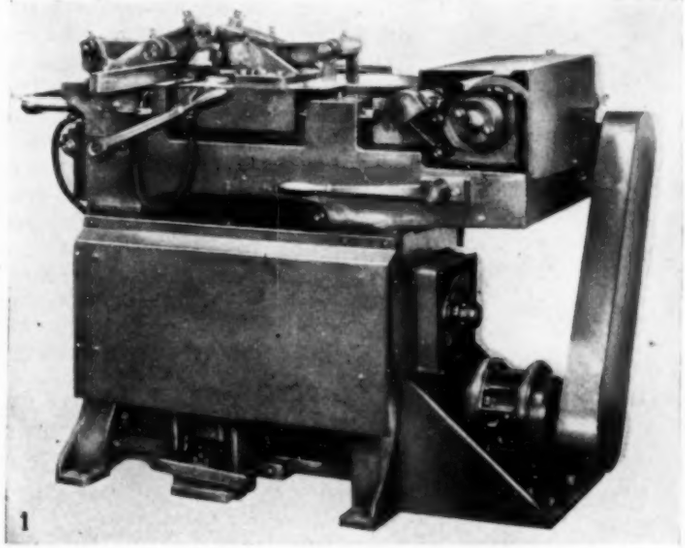


Westinghouse Type SK Totally-Inclosed Fan-Cooled Motor

further inclosed with a sheet-steel cover, having a perforated, protective end through which the fan draws the cooling air. Air is directed over the bracket and passes out over the top of the motor, covering approximately three-quarters of its surface. The motor is applicable in any location where the air is full of foreign matter injurious to motor windings, such as in coal-handling equipment, paint shops, foundries, and similar places.

Janette Speed-Reducing Power Unit

The motor-driven speed reducer recently introduced by the Janette Manufacturing Company, 556 West Monroe St., Chicago, Ill., consists of a worm-and-gear reduction unit inclosed in a cast-iron housing which is bolted to a motor frame. The flange of the gear casing forms the end frame of the motor. The unit is



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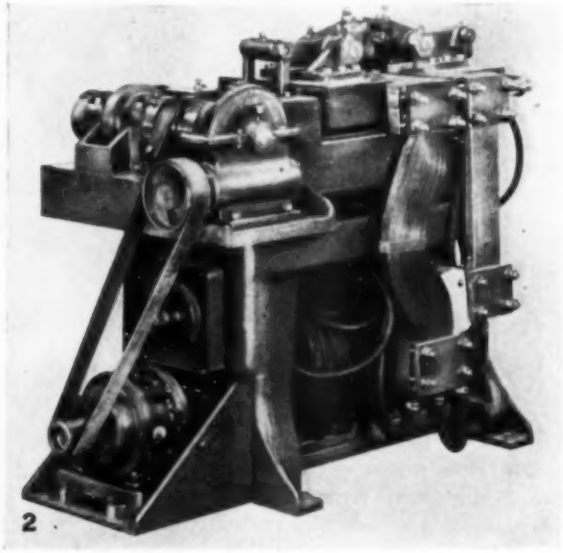

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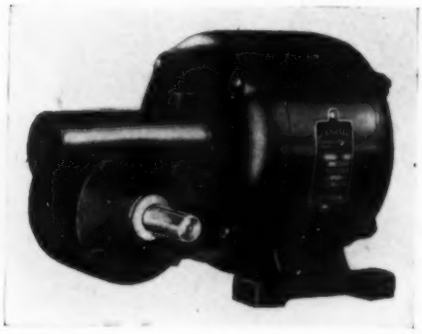
Fig. 1—Front view of Thomson Power Miter Welder. Fig. 2—Rear view of the machine showing the method of drive, and the large electrical connection to the moving platen



Janette Speed-Reducing Power Unit for right-angle drive

available with motors ranging in capacities from 1/30 to ¼ hp., and with speed reductions ranging from 20 to 1 up to 50 to 1. Standard gear ratios may be obtained as follows: 20, 26, 32, 34, 38, 40, 44 and 50 to 1. Special gear ratios will also be furnished. With a motor speed of 1,750 r.p.m., countershaft speeds are obtainable from 87.5 down to 35 rev. per minute.

The worm is of hardened steel and the gear is of Bakelite. The gear housing is made oil-tight and is filled with oil at the factory. No further lubrication is required during the life of the unit except an occasional greasing of the front motor bearing. Motor bearings are of the Fafnir ball-bearing type. Standard Janette motors are furnished in either d.c., or split-phase, or repulsion-induction, a.c. types.

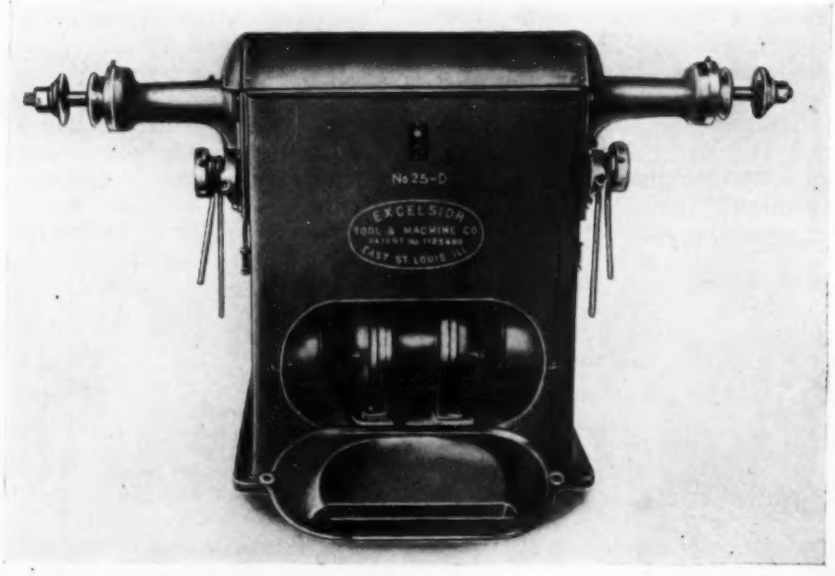
Excelsior No. 25-D Double-Spindle Polishing and Buffing Machine

TWO entirely independent spindles are featured on the No. 25-D double-spindle polishing and buffing machine made by the Excelsior Tool & Machine Company, East St. Louis, Ill. A single motor drives both spindles, and any kind or type of motor can be installed. Drive is by belt from pulleys at each end of the motor. By varying the pulley diameters from 4½ to 8½ in., the spindle speeds can be varied from 1,500 to 2,750 rev. per minute.

The spindles are entirely independent of each other and can be operated at different speeds, one for polishing and the other for buffing, and they can be locked so that tight-fitting wheels can be readily removed. An inside lever is used to raise each head, thus tightening the belt to the proper tension so that any reasonable pressure can be applied to the wheels without the belt slipping. An outside handle is used to lock the head in position. By releasing this handle the head is lowered until it rests on a friction block under the pulley, thus stopping the spindle instantaneously. The spindles together with the housings can be raised out of the frame without removing any bolts.

Ball bearings inclosed in dust-proof housings are used in the spindles, and the motor is also a ball-bearing type. The entire machine is inclosed and is built in one unit for heavy duty without vibration. Screened dust plates in both the front and the rear allow a free circulation of air around the motor to prevent it from heating under any circumstances.

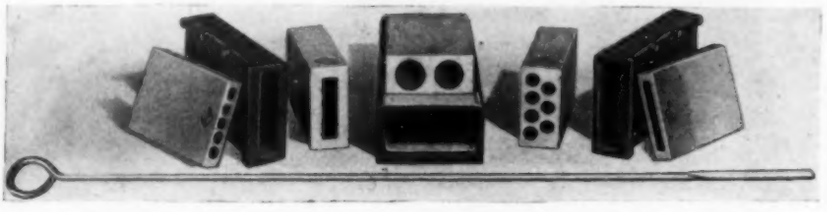
The machine is regularly supplied with a 7½-hp. motor operating at 1,800 r.p.m. and wired for 220- or 440-volt a.c., 60-cycle circuits, in conjunction with a magnetic switch or push button control. Motors of 5- and 10-hp. ratings can be furnished extra. The normal wheel capacity is 16 in., maximum face 4 in., and the spindle size 1½ in. at the wheel. The spindle is 39-in. from the floor. The complete machine weighs 1,400 pounds.



Excelsior No. 25-D Double-Spindle Polishing and Buffing Machine

Sentry Diamond Block for Hardening Steel

The method of hardening high-speed steel recently developed by the Sentry Company, Taunton, Mass., is reported to be a new process. The equipment consists of blocks of a carbonaceous material somewhat resembling graphite. These blocks are pierced to receive tools of different shapes. Tools of a round or square cross-section are hardened best in a round hole with a diameter not very much larger than their own. The



Muffles and blocks used in the Sentry Diamond Block High-Speed Steel Hardening Process

reason for this is that the material from which the blocks are made gradually gasifies, and by its action prevents oxygen from attacking the steel. If the aperture were too large, eddy currents would be set up that would allow oxygen to enter. The material used in the blocks will not attack either the furnace or the steel. The process has been in use for over a year, but not on sale, and the results secured have shown perfect hardening without variation, and the parts have come out clean, and with sharp corners.

The block used in the furnace is protected by a silicon-carbide muffle, which prevents the outside of the block from wearing away. The muffle and blocks will satisfactorily withstand a temperature that will melt the corners of steel placed in them. It is stated that alloy steels can be hardened without decarbonizing their surface. Production depends upon the application, of course, but a production of 4,000 $\frac{3}{16}$-in. taps per day is reported, using two No. 1 blocks.

Each piece is hardened individually. A spoon of heat-resisting alloy with a semi-circular section slightly smaller than the hole is furnished for inserting the parts into the blocks.

Taps, reamers and similar parts may be sharpened and honed before hardening and will need no further attention after it. The blocks and muffles will be furnished in a variety of standard sizes, and special sizes will be furnished where desired.

Cincinnati Bickford 21- and 24-Inch Slinding-Head "Direct Drive" Upright Drills

IMPROVEMENTS on the 21- and 24-in. "Direct Drive" upright drills manufactured by the Cincinnati Bickford Tool Company, Oakley, Cincinnati, Ohio, consist principally of a sliding head and a box column. The sliding head may be clamped at any position within a 6-in. vertical movement, whereas formerly the head was bolted in any one of three definite positions, there being 2½ in. between successive locations. The heavy rectangular column gives greater rigidity than formerly, and permits the use of raising blocks between the two column sections, when greater distances between the spindle nose and work table are desired. Greater distances between the spindle and the face of the column can be obtained by the use of offset blocks.

For single-purpose work the upright drill is built to run at one definite speed and feed, and if hand feeding is sufficient, the power feed mechanisms may be eliminated. Two speeds are sometimes required and to meet this condition a quick-change clutch, which provides them through back gearing, may be obtained. The ratio between the high and low speeds is usually 2 to 1, although a ratio of 4 to 1 can be provided. Greater flexibility can be obtained by using a d.c. variable-speed motor or an a.c. multiple-speed motor. Spindle speeds may then be as low as 34 r.p.m., or as high as 1,000 r.p.m. On single speed machines, the spindle speed may be anything from 800 to 68 r.p.m. for both sizes. A selective quick-change feed mechanism can be supplied which provides five changes in feed from 0.006 to 0.018 in. per revolution. A single feed can be supplied at any one rate between the limits of 0.004 and 0.028 in. per revolution.

The machine illustrated is provided with a tapping attachment located directly on the spindle and completely inclosed. The forward and reverse driving clutches are mounted on the outside of the bevel driving gears. Tapping clutches are conveniently controlled. Automatic reverse of the spindle assures uniform tapping and increases production. This feature is extra. Adjustable trip dogs may be set to reverse the tap at the proper depth.

The spindle is multiple-splined, having six splines in all. It is of special alloy steel having an ultimate tensile strength of 200,000 lb. per sq.in. The feed pressure is taken by a large ball thrust bearing. Spindle bearings in the sleeve are bronze bushed. The spindle unit is balanced by accessible weights in the column. To facilitate quick return of the spindle, a heavy spring at the top of the spindle is used. When drillheads are to be used, the lower end of the spindle sleeve is flanged. Large drillheads may be supported by a guide block bolted to the face of the column.

The table on the box column machine is bolted to the face of the column. For occasional vertical positioning, holes are tapped at 3-in. intervals. The extreme positions afford

Cincinnati Bickford Sliding-Head, Upright, "Direct Drive" Drill equipped with a tapping attachment

a vertical adjustment of 12 in. The entire mechanism of the machine is so contained in the upper section that it may be employed for gang drill construction, it being necessary only to mount the required number of units on a common base.

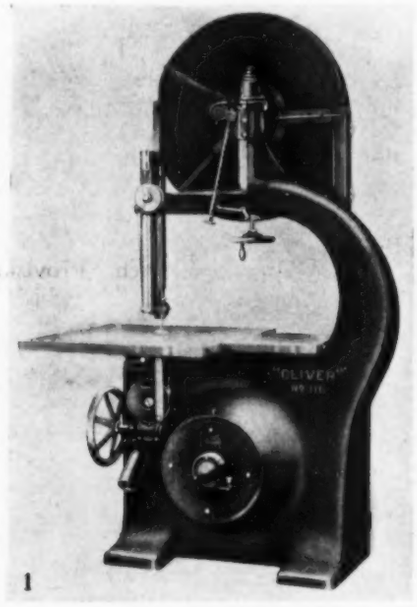
The 21-in. model will drill to the center of a 19-in. circle, whereas, the 24-in. model will drill to the center of a 22-in. circle. Other specifications given for the two sizes are as follows: Maximum distance, spindle to table, 2 ft. 5½ in. and 2 ft. 8 in.; minimum distance, $3\frac{1}{16}$ in. and $3\frac{3}{4}$ in.; maximum distance of spindle to base, 3 ft. 7¼ in. and 3 ft. $8\frac{7}{8}$ in.; minimum distance of spindle to base, 2 ft. $5\frac{5}{16}$ in. and 2 ft. $4\frac{5}{8}$ in.; spindle travel by hand, $8\frac{15}{16}$ in. and 11¼ in.; with power feed, 8 in. and 9¾ in.; table

working surface, 21x16½ in. and 24x 19 in.; vertical adjustment, 12 in. in both cases; minimum distance floor to table top, 19 and 18⅞ inches.

The amounts of floor space required by the respective models are 2 ft. 3 in. by 3 ft. 6 in. and 2 ft. 6 in. by 3 ft. 11 in. The weights, including the motor, are 1,750 and 2,300 lb. net.

Oliver No. 116, 36-Inch High-Speed Bandsaw

CAPACITY to cut work up to 22 in. under the guide and 36 in. between the saw and the column is available in the No. 116, 36-in. high-speed bandsaw announced by the Oliver Machinery Company, Grand Rapids, Mich. Of particular interest to pattern shops will be the fact that a capacity of 22 in. permits high patterns to be cut on this bandsaw, and that it is furnished with a tilting table for a 45-deg. tilt in one direction and 7 deg. in the other to take care of draft in the pattern. Speeds of 750 or 900 r.p.m. may be obtained as standard, with other speeds up to 1,200 r.p.m. available as a special feature.



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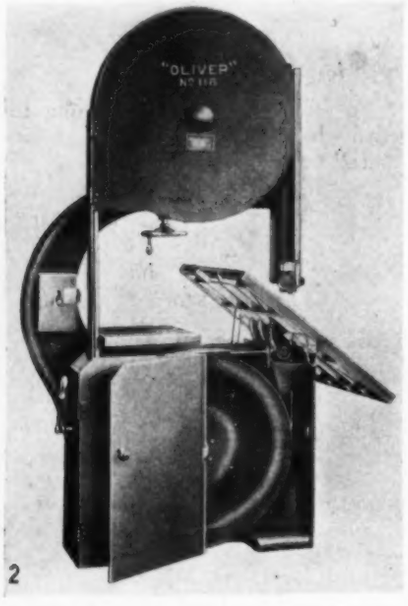

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Fig. 1 — Rear view of the Oliver No. 116 Bandsaw showing the motor unit inserted in the circular finished opening in the column, and also the circular exhaust pipe connection. Fig. 2 — Front view showing the folding door, double-rocker tilting table, exhaust hood, and brake lever

The lower disk wheel is driven directly by the motor. This motor is of the fully-inclosed, built-in type, and the motor parts are inserted in a finished circular chamber in the main frame. The motor is connected with a push button on the magnetic starter mounted on the machine. Other types of drives can be furnished, such as: belted, geared, coupled, silent chain, from a motor slung at the rear.

The disk wheels employed are of the five-ply laminated type, steel-clad, and have detachable aluminum rims vulcanized with live rubber. They are 36 in. in diam. and 2 in. wide, and are carried by finished, semi-centering hubs, which are taper fitted to the shafts. The lower wheel is swept clean by a brush. The upper wheel has a vertical adjustment of 9 in. and may be tilted for tracking the blade. The shafts are made of special spindle steel, ground and tapered. Both shafts run on oil-lubricated ball bearings. The machine is provided with indicator fingers to show the tension of the saw in a sensitive and positive manner. All adjustments are controlled by handwheels.

The saw blade runs fully-inclosed in a metal guard at the back of the machine. This guard has a narrow slot for inserting the saw. The upper wheel is totally-inclosed in a sheet-metal housing, the front half acting on hinges and swinging out for access to the wheel. The lower wheel is also totally-inclosed and has a two-piece sheet steel door. A hand lever within easy reach of the operator applies an externally-contracting band brake around a brake wheel, which is part of the lower wheel hub, in order to bring the machine to a quick stop.

Maximum floor space required is 30x50 in., and the horsepower necessary varies from 3 to 5, according to the work. The weight crated for the motor-on-shaft bandsaw, right hand, is 2,500 lb. net.

"Superior" Two-Spindle Vertical Milling Attachment for "Superior" Hand Milling Machine

A two-spindle vertical milling attachment is now available for application to the hand milling machine made by the Superior Machine & Engineering Company, 1930 Ferry Park, Detroit, Mich. This attachment is carried on the main spindle head.

The two vertical spindles are mounted on Timken roller bearings, and are provided with spring chucks

Double-Spindle Vertical Milling Attachment on "Superior" Hand Milling Machine

and draw-in bolts so that straight-shank end mills can be used. The main spindle head carrying the vertical spindle has a vertical travel on the column of 4½ in. by means of a hand lever. In addition, 6-in. longitudinal travel of the table by means of lever, transverse travel of 6 in. and vertical travel of 12 in. are available.

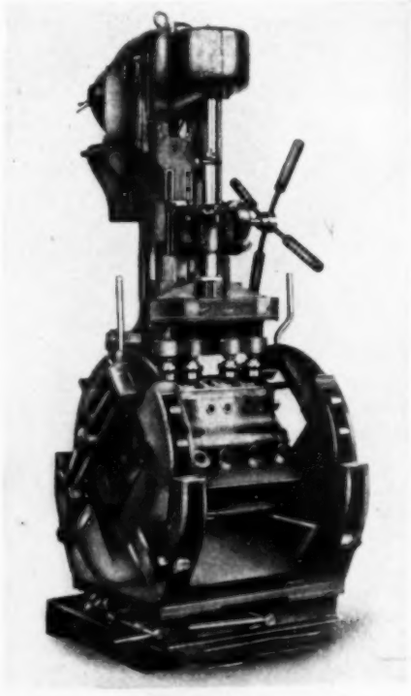
The main spindle head is guided close to the cutter by means of a long narrow way, and a taper gib is provided so that wear can be taken up.

The machine can be provided with either belt or motor drive, and it weighs approximately 1,000 pounds.

Cincinnati Bickford "Direct Drive," Upright Cylinder Block Chamfering Machine

THE adaptability of the line of "Direct Drive" upright drills described elsewhere in this issue, and built by the Cincinnati Bickford Tool Company, Oakley, Cincinnati, Ohio, is illustrated by its use for chamfering the cylinder bores of an eight-cylinder engine block. The engine block comes to this unit on a conveyor, after the cylinders have been rough bored and planed, for a chamfering operation at the top of the cylinder bores. With the clamp turned back, the block is rolled into the cradle fixture from the right and is located by the stud, the parallel guides above, and the clamp. The cradle fixture is then turned 45 deg. and four of the cylinder bores chamfered simultaneously. The drillhead is given a substantial support by a broad auxiliary slide on the column of the machine.

After chamfering the first four cylinder bores, the fixture is swung forward through 90 deg. and shifted laterally by means of a lever. The other four cylinder bores are then chamfered and the fixture turned back to the position for unloading. The bottoms of the bores are also chamfered in the same way in a similar unit.



Cincinnati Bickford "Direct Drive" Drill adapted to the chamfering of cylinder bores in an eight-cylinder engine block

Excelsior No. 19 Ball-Bearing Lever Punch

For particular use on the erecting or assembling floors where metal parts are to be fitted by punching and drilling and where there are no drill presses or punches in proximity to the work, the No. 19 ball-bearing lever punch has been developed by the Excelsior Tool & Machine Company, East St. Louis, Ill. It is readily portable and can be moved conveniently to the desired location without loss of time. The stand on which the unit is mounted has forward protruding legs so that the machine will not tip over when punching the full capacity, and two wheels are attached to the back of the stand whereby the machine can readily be pushed to any location.

Ball bearings are used on the eccentric and main shaft and it is claimed that a boy weighing 120 lb. can easily punch a $\frac{5}{16}$-in. hole in $\frac{5}{16}$-in. steel plate with only a 16 in., movement at the extreme end of the handle. This handle is balanced so that it always returns to an upright position for the next operation.

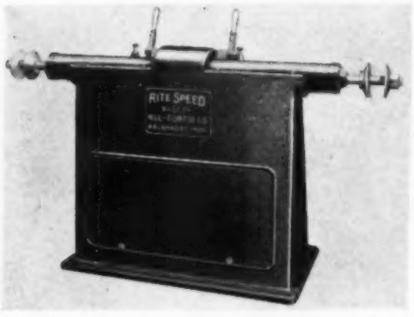
Excelsior No. 19 Ball-Bearing Lever

The design of the stripper is such that it does not obstruct the view of the punch. A tool-steel bushing in the slide is furnished for a $\frac{7}{16}$-in. punch shank, but by removing this bushing a $\frac{7}{8}$-in. punch shank can be used. The die holder is easily adjusted to suit the punch. Provision to take up wear on the slide, which is square, is a feature so that delicate, odd-shaped punches and dies can be used without injury, as in a punch press. Gages are provided on both the front and side and are adjustable to suit requirements. All punches for this machine have center points unless otherwise specified.

The punch is shipped complete with the stand and wrenches as shown and includes six punches and three dies. The throat depth is 6 in. and the die surface is 36 in. from the floor. The overall height is 51 in. and the machine weighs 450 pounds.

"Rite Speed" Double-Spindle Polishing Lathe

Designed with two entirely independent spindles and having two motors mounted in the base and two separate starting switches and brakes, a "Rite Speed" polishing lathe has been placed on the market by the Hill-Curtis Company, Kalamazoo, Mich. Power is transmitted to the spindle by means of multiple V-belts. Each motor and spindle can be started and stopped independently of the other, and each spindle can be operated



"Rite Speed" Double-Spindle Polishing Lathe

at different speeds. The speeds can be changed by changing the motor pulleys.

These machines are equipped with a Hill-Curtis combination switch and brake, patent applied for, eliminating the possibility of applying the brake before cutting off the current. With one push forward on the lever, the brake is released and the motor started. In reversing this action, the current is cut off and the brake applied.

Tapered roller bearings or ball bearings are optional equipment, and any standard motor can be furnished. The combination switch and brake with automatic motor starter, having thermal overload protection, is standard equipment. These machines are made in 3-, 5-, and 7½-hp. capacities for a.c. or d.c. circuits. The machine is designed along the general lines of the No. 5 two-spindle belt-driven unit.

"Camite" Tungsten-Carbide Cutting Metal

A tungsten-carbide cutting metal known as "Camite" has been placed on the market by the Cleveland Automatic Machine Company, 2269 E. 65th St., Cleveland, Ohio. In contrast with other recently announced materials of this type, Camite is an American development of a distinctive composition and produced by a process which is claimed to be entirely different from those employed by other manufacturers. The development work was done in the laboratory of the Electro-Alloys Company, which is closely allied with the Cleveland Automatic Machine Company. Among the claims for the material is that it has a degree of toughness difficult to realize in a material of such extreme hardness, the hardness ranging little less than that of the diamond. Camite resists the shocks of handling to a surprising degree for a material of its class, according to the manufacturer.

The metal is furnished in the form of platens in definite stock sizes, or special sizes and shapes are furnished to order. The platens are attached to suitable shanks or toolholders by brazing and then ground to a cutting edge. The material is marketed with claims of practically unlimited cutting speed so far as existing types of equipment are concerned. Its advantages, however, are not confined to making greater speed with customary tool feeds. Cuts of two or three times the customary depth have been made in long test runs without detriment to the tool, according to the manufacturer. It also will successfully accomplish intermittent cuts under severe conditions. While caution is advisable in handling a material of such extreme hardness, tests with tools held at normal and at super-normal distances from the cutting edge have been accomplished with success. The same results have been secured where a moderate amount of vibration was present during the cut.

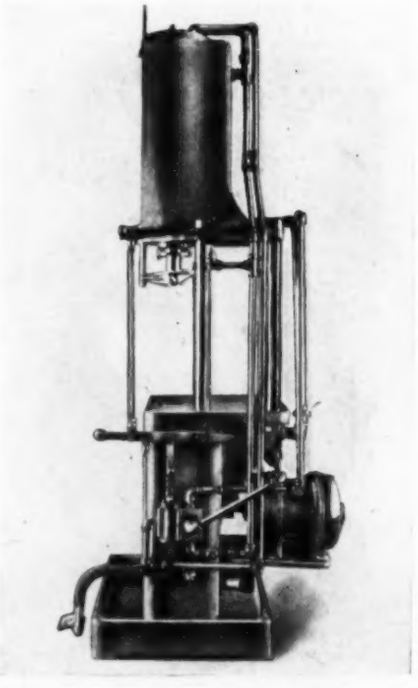
While suitable for finish cuts, Camite offers no such distinctive advantages in this field as it does in roughing operations, particularly the roughing of hard materials and those having an abrasive action. Castings with a high silicon content in the exterior, hard steels, brass, bronze and aluminum are machined with deep cuts at speeds that tax the limits of the equipment. It is understood that the price of Camite is moderate.

American Type V-4, 4-Ton Hydraulic Broaching Machine

STRAIGHTENING, assembly work, and broaching operations can be performed on the Type V-4, 4-ton hydraulic broaching machine announced by the American Broach & Machine Company, Ann Arbor, Mich. The machine has 23 in. maximum space between the table and ram. It has a 4-in. bore and an oil tank cast in jacket form around the cylinder. A balanced piston valve is a feature, and this can be supplied with either a piston valve giving full pressure in either direction or as a slip stem valve. With the latter valve the machine is suitable for straightening, as it gives flexible control and any pressure desired from zero to the maximum capacity by increasing the pressure on the treadle.

The machine is of the tie-rod construction and has a work table 24 in. wide, fitted with a direct reading gage reading in pounds and tons. Clear space in front of the tie rods to the center of the ram is 4 in. Adjustable knock-off stops can be set for any desired stroke. The pumping unit is of the internal gear type. The machine may be fitted with both treadle and hand lever control, and is arranged so that the ram automatically returns to the top of stroke upon releasing the operating lever. The unit is motor driven by means of a 5-hp., 1,200-r.p.m. motor and the ram has a downward speed of 18 ft. per min. and a return speed of 24 ft. per minute.

Floor space required is 4 ft. wide and 5 ft. deep. The overall height is 10 ft. The weight is 3,000 pounds.



American Type V-4, 4-Ton Hydraulic Broaching Machine

Asquith 12-Inch Metal Cutting and Piercing Machine

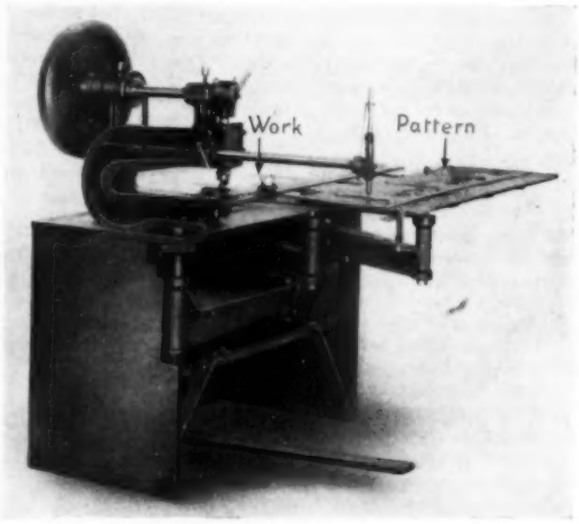
DUPLICATION of a pattern in sheet metal can be performed on this 12-in. automatic metal cutting and piercing machine developed by S. A. Asquith & Son, 2514 Sunset Blvd., Los Angeles, Calif. Both the stylus bearing against the pattern and the punch cutting the work are stationary in a horizontal plane while the pattern and the material are carried on a platen on frictionless supports free to move in wide latitudes in any direction in a horizontal plane. This construction permits exact duplication of the templet or pattern guiding the plate to be profiled or perforated in the sheet metal within small limits of tolerance if the diameter of the stylus is the same as that of the punch, and with it unskilled operators can produce satisfactory work.

Where a limited volume of production makes the use of profile punches and dies too costly, this machine can be used in place of the usual method of "hewing to a line" commonly employed. The punches and dies used on the machine are both capable of continuous resharpening, and when eventually worn out are replaceable at a nominal cost. As an example of the length of life, it is stated that a punch of 0.05 in. in diameter operated for 35 hours on 20-gage brass without resharpening. Punches as small as 0.020 in. in diam. can be used. The edges of the work require no finishing.

The main punch frame, which is of semi-steel, has a throat depth of 12 in., and provides a working area of 12x48 in. without disturbing the work or pattern. By turning over the sheet, the profiling of work 24 in. wide can be accomplished. Provision is made, by facing off the front of the punch frame, for the attachment of a high-speed wood or metal router which can be driven from the same motor that drives the punch.

The crankshaft and punch ram are made of chrome-vanadium steel, heat-treated and ground to size within close limits. A clutch key with 2-in. locking length is located in the crankshaft and permits high-speed operation with slight shock and little wear. A ½-hp. motor is used to drive the unit.

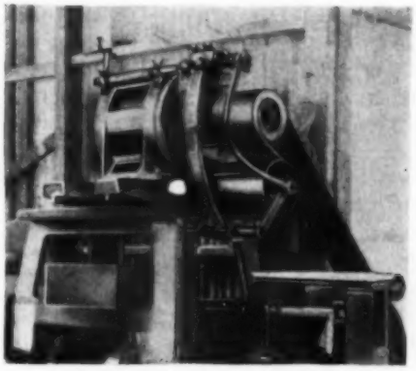
To change from one opening to another in perforated work the pedal is released and the punch automatically comes to a stop in the up position. It is then only necessary to raise the stylus to allow the work to be placed in a new position to start a perforation.



Asquith 12-Inch Automatic Metal Cutting and Piercing Machine used for cutting sheet metal to a templet

"Belt-Slacker" Idler Pulley Device

The so-called "Belt-Slacker" manufactured by Harry M. Perry, 638 North Main St., Los Angeles, Calif., is a mechanical adaptation of the idler-pulley idea to different machine conditions. Means are provided to maintain a tension on the belt that will be uniform but flexible, and in each individual case the tension is maintained by means of a spring, a weight, or gravity. The pulley is equipped with tapered roller bearings of a standard make, and it is claimed that the device saves 3 per cent of power, by decreasing the belt slip by that amount. The Belt-Slackers are manufactured to be mounted directly on a motor or machine, as shown in the illustration, or to be installed with an angular or tilting floor stand. The latter type is used to compensate for movement of a motor on its slide rail.



One type of "Belt-Slacker" Idler Pulley Device

General Electric Type AD Air Drawing Oven

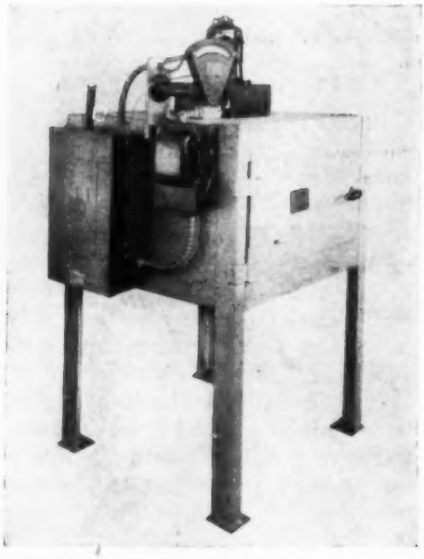
An air drawing oven, designated as Type AD, for drawing carbon steel at temperatures up to 750 deg. F. has been developed by the General Electric Company, Schenectady, N. Y. Any temperature up to the maximum can be obtained in the oven, thus covering the full range of temperatures required for drawing and bluing carbon steel. Only 0.9 kw. is required to maintain a temperature of 500 deg. in the oven, according to the manufacturer. When the oven is in daily use, only 25 min. are required to reach a temperature of 500 deg. F. in the morning. By installing a time switch, the oven can be automatically brought up to the temperature required before work is started, and can be cut off automatically at closing time.

Much less time is required to heat a given charge by the use of a fan located in the heating chamber than would be required by a "still air" type of oven. As a result, greatly increased production can be obtained.

The oven is of double-wall construction throughout, with the intervening space, which is 4 in., filled with heat-insulating material. Steel sheets form the walls, which are electrically welded together and rein-

forced by angles along the corners and extended downward to form the legs. The heating chamber is closed by a well-insulated and closely-fitted door. A strip steel grate for supporting the work forms the hearth, which is level with the inner edge of the door opening. One sheathwire heating unit is located at the top of the heating chamber, and a second is placed just under the hearth. Both windings are so distributed as to obtain uniform heating over the entire hearth.

The temperature control of the oven is fully automatic, consisting of an inclosed contactor panel and a controller. The controller can be set at any point up to 750 deg. F. and will hold the oven at a uniform temperature within a margin of 5 deg. without further attention. The heat-sensitive device located in the oven



General Electric Type AD Air Drawing Oven

chamber governs the operation of the controller, and the latter actuates the contactor through a relay, opening or closing the circuit as the temperature of the oven tends to rise above or fall below the setting.

The width of the oven chamber is 24 in., the detph, 21 in., and the height, 9 in. Outside overall width is 40 in., height, 61 in., and length, 33½ in. The door opening is 24 in. wide by 12 in. high. The hearth is 31 in. above the floor. Normal rating of the oven is 5 kw. and its capacity is 100 lb. of steel per hour at 500 deg. Fahrenheit.

REVIEW · OF · RECENT · PATENTS

Relating to the Machinery and Metal Products Industries

Metal-Working Machinery

The Long & Allstatter Co. was assigned patent 1,704,808 on a power shear for shearing sheet stock transversely and longitudinally. The machine permits movement of the stock transversely and has an opening to permit movement lengthwise.

A hob grinding machine was patented, 1,704,833, and assigned to the Illinois Tool Works. The hob spindle is movable axially, and is geared to the lead-screw and mounted to rock in its bearings in order to move the hob in accordance with the relief on the hob teeth.

A patent, 1,704,933, on a metal-polishing machine was assigned to the Scholl Manufacturing Co., Inc. The polishing wheel is mounted in a head on the machine frame, and a table is arranged to slide on a bracket, which also has a vertical adjustment.

In a grinding machine patented, 1,705,114, and assigned to the Heald Machine Co., the table is reciprocated and its movements are controlled automatically by movable stops.

The R. K. LeBlond Machine Tool Co. was assigned patent 1,705,218 on a milling machine. The feed comprises a train of selective gears terminating in a ratchet gear, and the idler gears are on the clutch shaft meshing with a pair of gears on a jackshaft. A pair of shifters operates the clutch and the independent drive through the jackshaft.

Cincinnati Grinders Incorporated was assigned patent 1,705,230 on a grinding machine having a pair of wheels moving at different speeds and in opposite directions, and having a third rotary member projecting into the throat between the wheels for supporting the work.

Parts and Mechanisms

An oil feed pump was patented, 1,794,704, by Albert E. Grant, of New York, N. Y. It consists of a geared pump so arranged with one gear on a slide that the volume of oil pumped may be varied by adjusting the screw on the slide.

In an automatic thread-cutting die patented, 1,794,741, by James Hartness, of Springfield, Vt., the chasers are in carriers that are actuated by a sleeve moving longitudinally in the die body, and the carriers are brought to open position by springs.

A hydraulic tailstock patent, 1,704,-852, was assigned to John Bath, Worcester, Mass. The tailstock center is connected with a cylinder and piston, the oil under pressure moving the center in one direction, and a spring adapted to move it in the other direction.

An automatic quick-change drill chuck patented, 1,705,275, by William von Newdeck, of Philadelphia, Pa., covers a small chuck having a pressure screw and tension device to bear against the chuck jaws.

A sheet-metal incased bearing was patented, 1,705,281 and assigned to the Norma-Hoffmann Bearings Corporation. The sheet metal casing is adapted to be mounted to the wall structure in a non-load-sustaining relation to the bearing.

A lubricant compressor patent, 1,705,-285, assigned to the Alemite Manufacturing Corporation, has a barrel with a conduit and coupling and a plunger held back by a spring. Another compressor patent, 1,705,283, assigned to the same company, has an external spiral cam on the barrel co-acting with an internal spiral cam on the cylinder.

A nut lock patented, 1,705,337, by David B. Penny, of St. Paris, Ohio, is essentially a pair of complementary locking nuts each having holes through which a tie wire can be extended and the ends twisted together.

Materials

A heat-resisting alloy patented, 1,704,733, by Frank A. Fahrenwald, of Cleveland Heights, Ohio, contains from 3 to 20 per cent of aluminum and 80 to 97 per cent of chromium.

A patent, 1,704,978, on a welding rod, assigned to the Rail Welding and Bonding Co., covers a rod formed into a hollow cylinder from ferrous sheet metal, and filled with a pulverized fluxing material.

A lubricating oil patented, 1,705,298, and assigned to The Texas Company, comprises a mineral oil and an oxidized paraffin wax, or a saponifiable material derived from the wax.

A method of making a molding resin from cumerone and indene was patented, 1,705,857, and assigned to the Neville Chemical Company.

An improved process of chromium plating was patented, 1,705,954, and assigned to Chromeplate, Inc. It consists in adding to the chromic acid solution freshly made silicic acid and then electrolyzing the solution.

The General Electric Co. was assigned a patent, 1,706,154, on a brazing alloy consisting mainly of copper, but containing about 8 per cent of tin and a considerable amount of silver, the alloy having a melting point of about 925 deg. Centigrade.

News of the Week

National and International Problems Discussed by U.S. Chamber

Stock speculation, credit and tariff revision receive attention

BEFORE the business men in attendance at the seventeenth annual meeting of the Chamber of Commerce of the United States had been in Washington 24 hours, it was apparent that most of them are in sympathy with the efforts of the Federal Reserve Board to curb excessive stock speculation. After listening to Representative Hawley, the chairman of the Ways and Means Committee, in support of the government's tariff policy and to the divergent views of C. H. Cahan, a member of the Canadian Parliament, the consensus of opinion seemed to be that any general revision upward of the tariff would be a mistake. The thought was expressed, however, that Canada's greatest interest is in the maintenance of the highest possible degree of prosperity in the United States. The innovation of round-table conferences to supersede the set speeches, which at previous meetings had taken up most of the time at the group meetings, met with general favor. These meetings fairly bristled with discussions. In this way, a much better cross-section of opinion was obtained than under the old plan.

Attendance at this year's annual meeting, which was held April 29 to May 3, exceeded by more than 10 per cent the number in attendance at last year's gathering.

Discuss Federal Reserve Act

In connection with the discussion of the credit situation, it was very clear that no sentiment exists for legislation intended to regulate the Stock Exchange or to increase the powers of the Federal Reserve Board. Some favor minor changes in the Federal Reserve Act, but even that group agrees that this is not the time to open up that law for revision. As one member expressed it, the Federal Reserve Board is a great organism, destined to grow and to develop. Opportunity should be afforded to stimulate its growth and usefulness, but that end would not be gained by pulling it up to look at its roots. The Board should have more authority to experiment in a careful way with financial policies so as to be able to determine which types of procedure are best. There was unanimous opposition, however, to legislative mandates that would commit the Board to definite policies without this essential experimentation.

Discussion of the tariff brought out the very generally-held opinion that great care must be exercised to prevent excessive rates. The serious consequences of retaliatory measures by the rest of the world were stressed. Charles O'Connor, of Oklahoma, agreed to the principle of protection, but warned against going "hog wild" about it. A representative of the National Dairy Federation said there must be a tariff for all or a tariff for none. Julius Barnes urged that American business should be honest about the matter and not overstate its case.

Representative Hawley's Address

Great interest was shown in the address of Representative Hawley, since all information as to what had transpired in the Ways and Means Committee had been withheld up to that time. He revealed that the committee had repaired the defenses where the attacks are making inroads. He called attention to the improvements and developments which have taken place since the enactment of the present law. These, he explained, have changed competitive conditions that require tariff adjustment. There is no intention, he said, of excluding foreign products from the American market, but it is the committee's intention, he declared, to admit them under such conditions as not to throttle American industries. He, too, pointed out that tariffs cannot take the place of sound management and proper location of industry. There has been no thought of basing rates on the costs of production at plants which have been located without proper reference to the sources of their raw materials, the markets which they serve and the facilities of transportation.

The round-table conference on tariff principles developed into a somewhat acrimonious and controversial discussion of the many conflicting ideas that have been argued pro and con during recent months in Washington. Representatives of the various manufacturers' associations, agricultural interests, importer and exporter groups, chambers of commerce, and trade agencies of many types presented their several theories as to how the tariff of 1929 should be drawn.

Most of the controversy settled around two subjects, the flexible tariff and the proper basis for valuation of goods subject to an *ad valorem* duty. The only idea which appeared to receive unanimous support was that the tariff should be so drafted as to benefit the American people as a whole. How this obvious objective was to be reached apparently could not be agreed upon by any large percentage of those present, regardless of which phase of the subject was under discussion.

The Fordney-McCumber tariff was a severe blow to Canada, Mr. Cahan told the assemblage. It made necessary the finding of markets abroad for a large volume of Canadian products formerly sold in the United States. During the last calendar year, he pointed out, 67 per cent of all importations into Canada were purchased in the United States. In that year Canada bought commodities in the United States to the extent of $826,000,000. American purchases in Canada were $493,000,000. To meet liabilities for American purchases Canada was compelled to seek markets abroad in order to procure from those sales bills of exchange to the amount of $333,000,000 in order to pay for the excess purchases from American producers. He also pointed out that Canada had not suffered alone from the loss of business in the United States, but had been deprived of the services of a million native-born Canadians who had been educated and trained in the Dominion and who migrated to the United States. Mr. Cahan frankly admitted that the tariff policy of the United States was spurring Canada to an increase in the production of those commodities now being imported principally from the United States. He invited American industrial concerns to cross the northern border and establish branches in the Dominion.

One of the important contributions to the meeting was the address of Earl Elijah, a "dirt" farmer from Clarence, Iowa. He believes that the farmers of the country are willing to give agricultural relief legislation a fair trial, but he expressed the opinion that much in addition could be accomplished by the co-operation of agriculture and industry. He listed the chief problems of the farmer as follows: instability of prices; a credit system unsuited to agriculture; high costs of production; high costs of marketing, and burdensome taxes.

Congressional Meddling

The Hoch-Smith resolution came in for scathing criticisms. The action of Congress in meddling in the field of rate-making has had the effect of tieing up all progress in that direction. One thousand Solomons could not put into effect the principles of the Hoch-Smith legislation, one speaker declared. Farmers joined with other shippers in denouncing Congressional interference with the technicalities of rate making.

A conception of the place of the trade association in the life of the nation was voiced by William Butterworth, president of the Chamber. "It offers to industry," he declared, "the facilities for intelligent research of production

and marketing, of administrative methods and technique and for searching out the possibilities which science and invention may offer for the progress of individual units and of industry as a whole. The trade association regiments the industry, enabling it to form lines of offense and defense in the competition of industry with industry—a competition more vigorous and more intensive than the competition of unit with unit within an industry.

"The trade association is a forum in which the enlightened opinion of an industry may legislate for self regulation, self government, by establishing sound standards of practice and of conduct. This unity of opinion is a potent sanction. In a democracy, either political or industrial, there can be no stronger."

Increase of the nation's manufacturing-plant capacity through modernization of equipment and relocation of factories was discussed at another one of the round-table conferences. A. L. Scott, of Lockwood, Greene & Co., engineers, declared that many of the nation's major industries are on the whole economically located. He called attention to such examples as the central position of Detroit for automobile manufacturing, and Pittsburgh and Birmingham for steel making. He defined excess capacity as depending solely on the changing public taste or style in the commodity under consideration. In locating any industry, the principal economic factors involved must first be carefully considered, insisted Mr. Scott. Thus if power costs are a large factor in the product, electricity must be considered. If heat is a factor, the supply of natural gas or coal must be studied. If labor is a large item, wage scales and labor supply become important. If transportation is involved, railroad or other freight facilities must be analyzed.

L. S. Horner, president, Niles-Bement-Pond Co., New York, declared that the strictly economic factors must always control the location of any manufacturing operation. Present capacity of the industry as compared with present demand for its products should also be determined. Investigation of the industry's profit-or-loss situation should be made also, observing whether the industry is doing its present business on a margin that justifies expansion.

Possibilities of expanding production through modernization of factory equipment were discussed by Prof. R. H. Lansburgh of the University of Pennsylvania. In the machine-tool field, lathe, drilling and milling operations to the number of five or six, are being handled by single automatic machines. A large publishing house has cut its bookkeeping staff to one-third by developing new accounting machines along cash-register lines. Both the attitude toward increasing effectiveness of plant machinery appears to be largely a matter of local groups or communities. Some communities are characteristically backward, others progressive. Local Chambers of Commerce, he stated, can well take the lead in encouraging such modernization.

In the automobile industry, some machinery is now regularly written off after one year's service. Other types of plants figure on replacing equipment in two to five years. In oil production, equipment life of five to ten years is the limit. In the changing, competitive situation of today, said Prof. Lansburgh, no longer can factory equipment be amortized over such long terms as twenty years, as was common practice prior to the Great War.

A. V. Snell of the Chamber of Commerce of Pittsburgh, Pa., protested against "industrialitis," or a desire on the part of communities to "grab everything" in the way of new industries or plant extensions, whether basically adapted for their localities or not. He urged careful study and development of each community's own specific possibilities, and advised conservative sound policies built upon local conditions and existing plants.

Regulation of the new invisible money market was held by Leonard F. Ayres, vice-president of the Cleveland Trust Co., to be a necessary step in meeting the credit situation. The main cause of the present credit inflation, Mr. Ayres said in the course of his remarks at the general session on Thursday afternoon, is due to the fact that corporations enter the banking business when they have excess funds. They lend these funds to the call money market. "There is going on in this country a very serious degree of a new kind of inflation," Colonel Ayres said, "one that is rapidly impairing the usefulness of our commercial banking system. Corporations take money out of the banks and use it in the loan market."

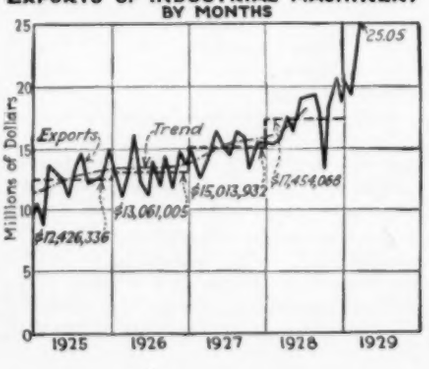
A plea for general support of the trade practice policy of the Federal Trade Commission was voiced by Christie Benet, general counsel of the Interstate Cottonseed Crushers Association. He suggested that no new laws are needed; that there is no need for the repeal of the Sherman law; that there should be an interpretation of law by men trained in economics, as well as on the legal side; that facilities for trade practice conference work be provided at regional offices so as to make it more convenient for business men to confer with representatives of the Commission; that industries which do not feel it necessary to have a formal conference be allowed the right to file voluntarily a statement of the rules under which they propose to operate; that the Department of Commerce and the Department of Justice be parties to trade practice conferences.

In the opinion of C. F. Kettering, vice-president of the General Motors Corporation, expressed at the general session Friday morning, the success of the business man of today depends largely on the amount of science he applies to the conduct of his business. "Advancing waves of other people's progress sweep over the unchanging man and wash him out. One thing that distinguishes the United States is its ability to absorb change rapidly."

Industrial Machinery Exports in March Highest Since 1920

EXPORTS of industrial machinery from the United States took a sharp upward turn during March to reach the high total of $25,050,782, exceeding the monthly average for any year since 1920, according to L. J. Cochran, Industrial Machinery Division, Department of Commerce. This represents a gain of $5,489,000 over the preceding month, and of $7,747,000 over March, 1928. Export figures for the three-month period ended March, 1929, show a gain of $17,218,000 over the corresponding three months of 1928 and further confirm the steady upward trend in American machinery exports since the slump of 1922. This trend is graphically portrayed in the accompanying chart.

EXPORTS OF INDUSTRIAL MACHINERY BY MONTHS



The sharp rise in industrial machinery exports during March 1929, as compared with the corresponding month of the preceding year, is chiefly accounted for by greatly increased shipments of internal combustion engines, and well and refinery, pumping, and metal-working machinery, although gains were general all along the line. Of the principal classifications, steam engines alone showed a decline under March 1928, but the amount involved was insignificant.

Among the principal items, exports of well and refining machinery, which during several months past have shown increasing activity, rose by 45 per cent during March 1929, as compared with the same month of 1928, and by 75 per cent during the three months ended March 1929, as against the corresponding period of the preceding year. Foreign shipments of pumping machinery showed outstanding gains, increasing by 96 per cent over March, 1928 and by nearly 90 per cent over the first quarter of last year.

Another classification particularly worthy of note was metal-working machinery. Total exports of this group rose by 83 per cent and 46 per cent

respectively over March and the first quarter of 1928, particularly substantial gains for both periods being registered by engine and turret lathes, gear cutting machines, sheet and plate metal-working machines, foundry and molding equipment and pneumatic portable tools, although practically all items in this classification showed increases. In the construction and conveying machinery group, there were no such extraordinary gains as indicated above, but the previous steady upward export trend was maintained and for the first quarter of 1929 a new record was established.

The large and important "other industrial machinery" group also shared substantially in the general upward trend, exports under this heading in the first quarter of 1929 exceeding those for the same period of the preceding year by nearly 32 per cent. Increases in this group appeared chiefly in the case of refrigerating equipment, ball and roller bearings and parts, foreign shipments of which nearly doubled, cigarette and cigar making and other tobacco machinery, air compressors, and iron or steel body valves, exports of the last named being nearly three times the corresponding figure in the first quarter of 1928. On the other hand, there were several declines in this group affecting such principal items as bakery machinery and parts, and sugar mill, paper and pulp mill, saw mill and brewery machinery.

Management and Materials Handling Convention in Detroit a Great Success

THE Second National Meeting of the Management and Materials Handling Divisions of the American Society of Mechanical Engineers, with the American Management Association co-operating, opened in Detroit on May 1st with a registration of over 300 on the first day.

At the first session, James Lynah, Works Managers' Committee, General Motors Corporation, discussed "Management Applied to Materials Handling." He pointed out the relation of material handling to the worker, the influence of wage incentives on the worker, control of inventories to reduce manufacturing costs, and the principles and results of conveyor pacing of work. Hugh Dean, manager of the Forge Division, Chevrolet Motor Co., presented a paper dealing with "The Forge Shop." In 1928 the company processed 202,000 tons of steel of 90 sizes and 17 specifications, in the manufacture of 101 different types of parts. "The Foundry" was the subject of a paper by L. W. Pardee, plant engineer, Wilson Foundry and Machine Co., Pontiac, Mich. This company is producing between 400 and 500 tons of castings per day, in a plant built for only half of this output. Continuous molding and pouring conveyors, shake-out conveyors, and a conveyor system for collecting finished castings throughout the foundry and delivering them to the machine shop, together with trestles for unloading incoming materials and a complete cupola charging system, have made the increased output possible.

At the Wednesday evening session, John M. Carmody, editor of *Factory and Industrial Management*, presented a general survey of the material-handling situation. He pointed out the tendency toward inertia in many plants leading them to be content with obsolete equipment and with methods a quarter of a century old. As a contrast he cited instances of progress made by other industries, such as those in the automotive field. George E. Hagemann, associate editor of the *American Machinist*, gave a paper on "The Sheet Metal Shop," explaining the fundamentals of management in the operation of such shops, their layout, inventory control, routing of materials and the modern methods of material handling employed. One such plant making over 1,500 automobile bodies daily, operates with a schedule only 4 hours in advance of the requirements of the final automobile assembly line. R. L. Lockwood, of the Division of Simplified Practice, stated that the Department of Commerce was considering the establishment of a material-handling division.

On May 2, Wm. Pfeil, plant layout engineer, the Studebaker Corporation of America, gave a most interesting illustrated talk on the application of conveyor handling, modern cleaning methods, and spray painting methods in the manufacture of body parts. Mr. Hagemann also contributed a brief paper on "Body Building," stressing the fundamentals of management and material handling.

On May 3 a session was held at which Gordon LeFebvre, vice-president in charge of operations, Oakland Motor Co., presented a paper on "General Assembly," discussing the problems arising in connection with the final assembly of the chassis, installation of the body, and completion of the car. "Handling Miscellaneous Parts" was the topic of an address by L. A. Churgay, Sr., of the Chrysler Corporation. Howard Flagg, General Motors Corporation, presented the subject of "Material Control," describing how the automobile company operates on minimum inventories, but nevertheless keeps all sub-assembly and major assembly lines supplied exactly on predetermined schedules.

The sessions closed with an important meeting showing how other industries have successfully applied the management and material-handling methods of the automotive industry to their own plants. C. W. Avery, president of the Murray Body Corporation, a man who has been called the "father of the conveyor," gave a paper on "The Glass Industry." "The Electrical Industry" was the topic of a paper by E. L. Spray, chief engineer of the Mansfield Plant of the Westinghouse Electric & Manufacturing Co. "The Stove Industry" formed the subject of a presentation by Alvin G. Sherman, general manager, Detroit Vapor Stove Co., in which the problems of the sheet-metal industry were covered. H. M. Lane, consultant, Maytag Manufacturing Co., discussed similar subjects under the topic, "The Washing Machine Industry."

At a dinner of material-handling manufacturers on Wednesday evening presided over by George E. Hagemann, Chairman of the Materials Handling Division, Harold V. Coes, manager of the Industrial Division, Ford, Bacon & Davis, pointed out the difficulties faced by users of equipment in getting data necessary for the selection of correct types for an installation. H. E. Stocker, New York manager of the Munson-McCormick Steamship Lines, covered the same topic from the shipping angle, and Matthew W. Potts, of Alvey-Ferguson Co., presented the case from the consultants' angle. Mr. Hagemann discussed the advantages of technical publicity in bringing manufacturer and user together by pointing out the engineering and economic factors in existing installations. A motion was passed that the Materials Handling Division undertake the organization of a committee of engineers and manufacturers to formulate plans for the advancement of the material-handling field through the dissemination of information on the subject.

At the banquet on Thursday night, Carl J. Oxford, chairman of the Detroit Local Section, presided, and John M. Carmody, was toastmaster. S. W. Utley, vice-president and general manager, Detroit Steel Casting Co., outlined the humanitarian influence which the growth of industry had developed, and gave as the slogan of progress the phrase, "Think, Work, Produce." C. F. Hirshfeld, chief of research, Detroit Edison Co. gave an address on "Research."

Inspection trips were made to many of the automobile and other industrial plants around Detroit.

Gear Manufacturers Plan Cleveland Meeting

The American Gear Manufacturers Association is planning to hold its thirteenth annual meeting at the Hotel Statler, Cleveland, Ohio, on May 16 to 18. Among the papers to be presented are: "Gear Geometry," by Allan H. Candee, of the Gleason Works; "Load and Stress Cycles in Gear Teeth," by R. E. Peterson and R. V. Baud, both of the Westinghouse Electric & Manufacturing Co.; and "Carboloy and Its Place in the Industrial Arts," by E. G. Gilson, chief engineer of the Carboloy Co. At the informal banquet to be held on Friday, the 17th, the Hon. William R. Hopkins, City Manager of Cleveland, will be the principal speaker.

BUSINESS BAROMETER . . . . *In the major industries, the recession that many of the forecasters are anticipating still is deferred, despite dear money*

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

THE position of the money market is anomalous. Rates that would usually be regarded as inhibiting enterprise which involved the use of borrowed capital are being paid all over the world. But business does not appear to be much affected, and the price that can be obtained for call money in New York is attracting the idle bank balances of many who have not hitherto been lenders in Wall Street.

As an example of this, it may be mentioned that in legal proceedings recently, it was disclosed that a prominent Protestant church in New York City was lending $100,000 on call, and that some financiers have organized the First Call Money Company of America, whose avowed purpose is to assemble funds to finance the marginal or installment purchases of the ten or fifteen million persons who are supposed to be interested in buying or selling securities.

Such developments as these are without precedent in the financial history of the United States. They have resulted in the creation of what has been called the "invisible banking system," or a secondary money market that is more or less independent of the control that the banks have hitherto exercised over the distribution of the world's supply of lendable capital. During the three months that have elapsed since the Federal Reserve Board set out to check the use of credit by the stock market, the loans to brokers by "all others" have increased $250,000,000, while those loans which are directly under banking control have decreased $400,000,000. It is assumed, therefore, that the high rates will continue to attract funds from other sources sufficiently to offset those withdrawn by banks.

This is the view upon which speculative leaders in the stock market seem to rely, and the result has been a sharp recovery in the price of many industrial securities, which has carried the "averages" to a new high point. The improvement was helped by a statement showing that the profits of the United States Steel Corporation for the first quarter of the year exceeded $45,000,000, and reports from many other large companies showing earnings that were in excess of what had been anticipated.

Prophecy is futile in the face of a situation so novel, and while dear money and high prices have not hitherto been regarded as consistent, it may be that they will continue to go hand in hand for a while longer.

Meantime it must be admitted that there is no general recession in business, although the difficulty of selling new bond issues is exercising a restraining effect upon those communities that must borrow in order to finance the public improvements and new construction to which they are committed. It is also rousing fear that the decrease in the flotation of foreign loans in this country will be followed by a falling off in our exports, inasmuch as many of our creditors can buy from us only to the extent that they can borrow the credit with which to pay. Perhaps a realization of this, until now mostly subconscious, is a factor in the present decline in commodity prices.

In the major industries, the recession that many of the forecasters are anticipating still is deferred. Although it was reported during April that new buying of steel was less than production, the reviews now say that unfilled orders showed no decrease during the month. Despite the fact that automobile output is at a yearly rate which far exceeds the country's requirements, there are few signs of slowing down and the makers of the popular cheap cars are still expanding. Building has picked up a little, and in general the industrial record is one of nearly capacity operation.

The prospect that some farm relief measure will shortly be enacted by Congress has also improved the outlook, and while the relief that will be provided will not go much beyond telling the farmer how to help himself, it will remove a vexed question from the political situation, at least for a time. After the Farm Relief Bill has been disposed of, the tariff will come up for consideration, but if Mr. Hoover is as successful in expediting its consideration as appears likely he will be in getting action on farm relief, we may have a summer of comparative legislative quietude.

These are the considerations that seem to justify a restrained optimism with regard to the immediate future, but this optimism does not offset or fully dispose of the fact that dear money has always acted as a brake upon prosperity in the past, and that those who have any experience in pre-war finance are not yet willing to disregard precedents in forming their conclusions. In Wall Street some of the brokerage fraternity are talking easier money in the immediate future, and last week imports of gold totaling $21,000,000 were received. But these shipments are likely to be stopped soon by still higher European bank rates, if necessary, and as long as the stock market stands ready to gobble up any credit that commerce does not need, there seems little chance of an important recession in rates.

In Europe the outlook is still beclouded by the failure of the Conference on Reparations, but there are some who hope that a compromise settlement may yet be reached, upon the basis of the new proposal announced last Thursday. Pending such a settlement and the result of the British elections, to be held during the latter part of May, it is not to be expected that there will be any great revival of business overseas.

ALTHOUGH the feverish activity that has characterized machine tool sales since the beginning of the year has begun to drop off somewhat in certain sections of the country, there is still a very satisfactory volume of business being placed in all industrial centers reporting this week. Production of the machine tool plants is at capacity and little headway is being made in the way of decreasing the time between receipt of orders and the delivery of machines.

BUFFALO reports that the demand there continues with little abatement. Considerable industrial expansion is reported, particularly along the Niagara River. An excellent volume of business was placed in April in Cincinnati, particularly with the makers of large machinery. No sign of a general recession is seen in Chicago, where general industrial buying, added to railroad purchases, is keeping the dealers there busy. In Cleveland steady single-unit buying features the market, although there has been a decided decline in automotive purchases.

IN NEW ENGLAND April business was below that of March but the outlook is excellent. A similar condition was reported in Milwaukee and in Indianapolis, but business in both centers is found well above the level established in 1928.

OPTIMISM as to the continuance of the present level of activity is expressed on all sides and it appears that there will be no general recession in metal-working activity for some months to come.

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The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CHICAGO

The outlook for May in the machine tool industry, judging from the number of inquiries already received this month, seems to warrant continued optimism. In only a few instances are there heard reports of a recession from April activity, but these are so slight as to be almost negligible. Manufacturers' representatives and distributors of practically all lines of heavy-duty metal-working tools are booking orders subject to long delays in delivery, buyers seeming to have reconciled themselves to the existing situation.

There are no special features to report regarding the machinery trade. Railroads are closing on several items listed, and in two or three instances have sent out inquiries for additional requirements. The Rock Island and the Santa Fe are among the roads that have been buying against their lists. The Louisville & Nashville and the Northwestern are in the market for a number of units.

General industry is buying freely, and some good orders are reported from this source. In woodworking machinery there is reported to be some change for the better, but there still is considerable room for improvement in this line. Dealers in used tools report business as continuing on a good level.

CLEVELAND

Business for the machine tool trade has settled down to a steady, even trend of one and two piece buying with a total absence of any outstanding purchases of large lists. A feature at the present time is the increase of orders coming from miscellaneous users which has helped to keep the volume of sales on an even level. Buying by the automobile industry and its allied lines showed a sharp decline.

April equaled March in the total volume of business according to a few of the leading dealers. Continuation of satisfactory business for the near future is indicated by the increase of new inquiries.

The Cleveland School Board has closed for a list of tools for the new Wilbur Wright and Nathan Hale Schools. Employment, generally, showed an 8 per cent increase during April according to the American Plan Association.

BUFFALO

Demand for machine tools and electrical industrial equipment continues with little abatement, if any, despite the increase in prices in some quarters. We are now seeing the opposite side of the picture on the subject of hand-to-mouth buying. It kept inventories down during times of stress, but now we find that the lack of stocks of equipment and the habit of hand-to-mouth purchasing is putting the brake on the forward surge of business.

Aircraft industries are still demanding equipment in the Buffalo district and this demand is likely to continue for some time.

Increased activity is being experienced by the United States Radiator Co. which is concentrating its production at its Dunkirk headquarters. Dunkirk, where many of the industries have had trying times during the last few years, also comes into the limelight because of several large orders placed for equipment with the American Locomotive Company.

In Buffalo an expansion of facilities and the inauguration of higher production schedules have been announced for the Bliss & Laughlin plant as well as that of the new Arrow Head Steel Products Co. Industrial leaders estimate that there is likely to be capital expenditures of more than $10,000,000 for new industrial facilities or enlarged facilities of existing plants on the Niagara Frontier within the next few months.

This will also mean large expenditures in some instances for contractors' equipment, particularly with a large road building program in the offing. However, inclement weather continues to retard the work of contractors.

PHILADELPHIA

Sales of machinery and machine tools in the Philadelphia market have held up very well throughout the last two weeks. Dealers and manufacturers reported that the situation shows a very decided improvement over the corresponding period of last year, and that the sales have exceeded their earlier expectations.

The orders came from radio producers, steel mills, railroads, automotive centers, power plants, aircraft producers and general industrial lines. Both new and used equipment were included in the orders. Shop equipment for General Motors was in the list of sales, and some machinery went to the Atchison, Topeka & Santa Fe and the New York Central Railroads. Some additional purchases of textile machinery came from the Rayon Silk Mills, and the Victor Talking Machine Co. entered this market for some purchases.

Shops have been running on a high percentage of capacity, and inquiries coming from a well scattered area and covering a diversified line of activities, give indication of continued business.

Manufacturers of scientific testing equipment report brisk demand for their products, sales being to fifty different industrial lines.

NEW ENGLAND

As a whole New England machine tool business in April was below the March aggregate, while yet maintaining an excellent total. This condition holds true with used equipment dealers also. The month was fruitful of comparatively few of those orders classified as large, but was again featured by a remarkable total of single unit orders for both large and small tools. This demand was scattered over practically all lines of manufacture. In fact expansion of sales relative to diversity of manufacture was probably more pronounced than over any period this year.

It may safely be assumed orders for metal-working equipment are now being placed more conservatively. Through March and April a steady though slight decline has been apparent, which can only be taken to indicate a more natural level. Industrial activity, on the other hand, is going forward at full speed, due to the fact that many builders are sold months ahead. Prospective transactions, however, give promise of a continued healthy volume of business.

A Springfield and a Worcester company are representative heavy buyers of machine tools. Orders placed by these companies total a value running into six figures. A New Haven wire machinery company has a cable machine under construction for the Western Electric Co. to cost $500,000. Other heavy wire machine orders have come from Wallace Barnes Co., Bristol, Conn., and the Wickwire Spencer Corporation, Clinton, Mass. The Whittlesey Manufacturing Co., Bridgeport, is scheduled to produce 2,000 planes and will buy equipment. The Bridgeport Brass Co. has bought twelve engine lathes, and less recently some milling machines.

NEW YORK

Leading dealers in the Metropolitan district report that sales of machine tools reached a new high level in April after what appeared to be a record-breaking month in March. Much business is still pending, and all concerned are optimistic, although one firm reports a falling off in the volume of inquiries. All kinds of metal-working shops are represented in the buying, producing what is felt to be a good, healthy condition. One of the indications of general shop activity is the fact the sale of grinding wheels and small tools and cutters is exceptionally high.

Among the concerns entering the market for equipment during the last fortnight were: Singer Manufacturing Co., General Electric Co., Schenectady and Bloomfield; Western Electric Co.; and the Intertype Co. Among the shops reported to be well occupied are: International Motor Co., Hyatt Roller Bearing Co., Federal Bearings Co., Worthington Pump & Machinery Co., Wright Aeronautical Corporation, American Machine & Foundry Co., Eclipse Machine Co., Otis Elevator Co., in fact nearly all of the leading metal-working shops in the vicinity.

Sales made by the Triplex Machine Tool Co. in the past week included: an "Ohio" No. 2 miller, a sawing machine, a Deckel punch miller, and Excel filing machine, a universal grinder, and an Ames bench lathe.

DETROIT

There has been a noticeable let-up in the machinery field here, and while business is still very good, most dealers report that the usual summer slump seems to have been started.

Orders are still coming in for a great variety of equipment and a large number of inquiries are being received. There are apparently no expansions being planned and nothing of a spectacular nature is in the immediate offing. As always the automotive and associated industries occupy the center of the stage as far as the machinery and machine tool dealers are concerned. Without exception the plants in Detroit and all of Michigan are going at full blast. Consequently there is a comfortable replacement business and there is every indication that this type of orders will continue for a few weeks at the present rate or near it. Because the plants are engaged in heavy production there are few let-ups for alterations or for extensions.

A great many of the accessory manufacturers are making plans for increased production. The small tool and die shops are still busy and most of them are far behind on their orders.

It is of some interest to note the development in the field of aeronautics. The Continental Motors Corp. has developed an aircraft engine which is being produced at a high rate, the new Packard Diesel is almost at the production stage and now is making airplane accessories.

Employment throughout the entire Detroit industrial area is at a very high point as it has been for the past five months. This is true of Jackson, Flint, Pontiac,

Lansing, Saginaw and a great many smaller communities. An unusual amount of construction work is being done and this necessarily involves the purchase of considerable material.

MILWAUKEE

Reports concerning new business in metal working equipment continue to bear an optimistic tone, although the feverishness which has characterized the demand for five to six months appears to be wearing off. This has not caused any concern, so far as surface indications go; in fact, most factors in the industry appear to welcome a spell of relief from the heavy pressure that has been exerted upon them by the demands of buyers. Production is being maintained at capacity in nearly every instance, and it is expected that some headway is about to be made in balancing deliveries with shipping specifications.

A great many buyers, realizing that delays in deliveries were inevitable with tool shops crowded beyond capacity, have been anticipating their future needs to an extent not known since the World War, and while awaiting receipt of the equipment, which in extreme cases will require three to five-months' time, feel satisfied to sit back and get along as best they can. Although there is no fear of any sharp recession in the demand for their products which might, in five months' time, make recent orders for equipment superfluous for actual needs, nevertheless it is felt that the delivery situation by that time will have straightened itself out so that needs then may be covered with greater facility than at present.

The labor situation in machine shops has not shown improvement. The scarcity of men is as acute as before. The number at work in Milwaukee industry at the beginning of May was the largest in the history of the city.

INDIANAPOLIS

Business in machinery and machine tools shows little change in this area during the last two weeks. The average volume of sales is higher however than at this time last year. In fact the situation is more encouraging than it has been for months.

Perhaps the best customer is the auto mobile and allied industries. During the last two weeks the Marmon plant here has increased its capacity from 150 to 250 cars a day and promises are made of further production increases just as soon as new assembly lines can be established. This is particularly encouraging to the trade since it is believed it points to a further era of expansion in the entire industry. The body plants and accessory plants of the state are working steadily, with the body plants especially good buyers of special machinery. Drills, stamping machines, special woodworking machinery all are in good demand.

During the last two weeks there has been a lot of inquiry from the brick-making industry. Most of these plants are planning some additional equipment and replacements and are getting into production for the spring trade.

A considerable amount of small equipment is being disposed of to the various airports of the state. Most of this equipment is designed to make minor repairs, but the total volume is increasing virtually by leaps and bounds and from all indications will continue to increase during the summer months as more airports are put into operation.

CINCINNATI

An excellent volume of business in the past week is reported by machine tool manufacturers in the Cincinnati district, many of whom state that they made a gain over the previous week and none of whom report a loss. Makers of large tools, who cannot gage their business by the week, report that they did particularly well in the past month. The head of one concern which makes large tools exclusively stated: "We did more business in the first four months of this year than we did in the entire twelve months of the previous year. If we had any more business than we now have we would not know what to do with it." Another manufacturer of large tools stated: "Business is at a fine level. It is not coming from any special field, but from various sources."

With the great majority of the manufacturers the sustaining feature of the week's market was the sale of single tools to miscellaneous users. These purchasers were located in all sections of the country and their requirements were well diversified. The C. & O. R.R. placed several orders for equipment for its new shops at Huntington, it is stated, and other purchases are expected to follow in the next few days. Purchases of other railroads were largely confined to single items. One manufacturer reported a fair volume of business from the automotive field, but others report that sales to this industry were confined to single tools.

Selling agents report a very good demand in the week, with considerable livening up of the market in local and adjacent territory. The feeling in this branch of the trade is that the sales curve will continue to ascend for several weeks at least. Both the manufacturers and the selling agents report that the inquiries received in the past week were satisfactory as to volume and tone.

Pressed Metal Institute Meets in Detroit

At the annual meeting of the Pressed Metal Institute, held April 26 at the Detroit Athletic Club, Detroit, the following officers and members of the executive committee were elected: President, Lee C. Benner, sales manager, Pressed Steel Division, Motor Wheel Corporation; vice-president, Harvey S. Johnson, assistant sales manager, The Bossert Corporation; and members of the executive committee, George D. Shanahan, general manager, Motors Metal Manufacturing Co.; W. H. Schomburg, vice-president, Bingham Stamping & Tool Co.; Ernest H. Christ, vice-president of the Stanley Works; and Ralph B. Britton, also of the Stanley Works.

At the meeting, there was an address by F. Richmond Fletcher, of Scovell Wellington & Co., on "Making the Most of Your Cost Finding Methods," followed by a discussion. There was also a discussion on the predetermination of the drawing qualities of steel, and as a result it was decided to appoint a committee to line up all the available information on the subject. It was also brought out that intelligent, well-directed effort along the lines of redesign and redevelopment had been productive of increased business in pressed metal parts.

Business Items

The Wilcox-Rich Corporation is expanding its airplane engine valve division with an initial plant outlay of $150,000 for establishment of a special department for engineering development and manufacturing. The company has exclusive rights under the Herron patents to manufacture a type of salt-cooled valve of which approximately 20,000 will be shipped in April. This type of valve has been adopted as standard equipment for the latest Wright Whirlwind engines and is now in production for the United States Navy.

Establishment of Vancouver's first airplane factory will be undertaken at once, following the merger of Hoffar-Beeching Shipyards, Ltd., of Vancouver, with the Boeing Airplane Co. of Seattle, Wash., it has been announced by Henry Hoffar, president of the British Columbia concern. Terms of the merger provide for the formation of a company to be known as Boeing Aircraft, Ltd., of Canada. This concern will have exclusive manufacturing rights of all Boeing models for Canada and the sales agency for them in the British Empire. Canadian materials, including British Columbia spruce and copper, and Canadian engines manufactured in the Pratt and Whitney factory, will be used in the Vancouver plant.

The Newark Galvanizing Co. has opened a plant at 39 Verona Ave., Newark, N. J., for hot-dip galvanizing work. Theodore Hayes is manager of the plant, and Frank C. Zuch is president of the company. Mr. Hayes was formerly connected with the Staten Island Shipbuilding Co., and when that concern was merged with the United Drydock Co., the Newark Galvanizing Co. was formed, taking over almost the entire personnel of the Staten Island company. The plant is so situated that full cars can be taken into the works, unloaded, galvanized and loaded without any extra handling other than that necessary in the galvanizing process.

W. B. Richards & Co., Inc., specializing in scientific industrial management, have moved recently from 16 Exchange Place to 545 Fifth Ave., New York City. The concern was organized in 1901 under the name of Gunn, Richards & Co., and the present corporate name was assumed in 1917, when Mr. Gunn withdrew to become head of the U. S. Tire Co. The staff of the present company includes engineers, accountants, and business analysts. At the annual meeting of the company held in March, Willis B. Richards was elected president; Merritt Van Walkenburgh, vice-president; and A. P. Cramp, secretary.

The Audio Vision Appliance Co. has been formed as the manufacturing unit of the merged interests of the Victor Talking Machine Co. and the Radio Corporation of America, and will take over the Camden plant of the Victor company. E. E. Shumaker, president of Victor, is president of the new company. The new company was formed by the General Electric Co. and the Westinghouse Electric & Manufacturing Co., which have heretofore manufactured all appliances of the Radio Corporation.

The Brammer Washing Machine Co., Davenport, Iowa, was reorganized last week and Arthur M. Compton, for the last 10 years with Curtis Bros. & Co., Clinton, Iowa, sash and door manufacturers, has become general manager and treasurer. Dr. Henry Braunlich is president of the company; Henry W. Hubers, vice-president. With the reorganization the Brammer company takes over the H. F. Brammer Manu-

facturing Co., whose plant it had leased. New capital is being introduced preliminary to enlarged production.

The J. L. Osgood Machinery & Tool Co., Inc., 43-45 Pearl St., Buffalo, has been incorporated for $100,000. This corporation takes over the business in machinery, tools, and shop equipment conducted by J. L. Osgood as an individual for the last thirty years. It will also manufacture a special line of machinery and tools as in the past, but on a much larger scale. J. L. Osgood is the president, treasurer and general manager; John F. Guider is vice-president and manager of sales, and Carl E. Klingelhofer, secretary.

Eastern Steel Products, Ltd., shows material progress in its second annual report covering the fiscal year to November 30, 1928. Sales increased between 30 and 40 per cent as compared with the preceding year and profits were substantially higher. Total net income was $279,101 as compared with $153,993 in 1927. A. K. Cameron, vice-president and general manager, in his remarks to the shareholders, stated that the increase in business covered practically all the products manufactured.

The American Brown Boveri Co., Inc., has been organized as a subsidiary of the American Brown Boveri Electric Corporation to handle all electrical and mechanical operations exclusive of shipbuilding. George A. Burnham is president of the new company, and Maurice L. Sindebrand, vice-president.

The Omaha Standard Body Co., Council Bluffs, Iowa, has leased factory buildings of the Hawkeye Truck Co., Sioux City, Iowa, and will establish an assembly plant there. F. L. Hebard will be in charge.

Carpenter & Byrne, 4 Smithfield St., Pittsburgh, Pa., have been appointed sales representative in the Pittsburgh district for the Pennsylvania Pump & Compressor Co., of Easton.

Personals

DAVID A. CRAWFORD, executive vice-president of the Pullman Co., Chicago, was elected president of the company in the place of the late E. F. Carry, who died on April 24. From 1924 until 1928 Mr Crawford was president of the Pullman Car and Manufacturing Corporation. He had also been connected with the American Car & Foundry Co., as vice-president, and was at one time vice-president of the Rich Tool Co., of Illinois, and president of the Rich Tool Co., of Maine. At present he is a director of the Wilcox-Rich Corporation of Detroit.

DR. JULIUS KLEIN, mentioned in the April 25 issue of the *American Machinist* as being nominated by President Hoover for the position of Assistant Secretary of Commerce, was sworn in on April 30. For eight years he had been director of the Bureau of Foreign and Domestic Commerce, and he acted as one of Mr. Hoover's principal advisors up until the time of Mr. Hoover's nomination.

A. A. OSSWALD, for the past three years connected with the Cleveland Punch & Shear Co., of Cleveland, Ohio, has joined the V & O Press Co., of Hudson, N. Y., as a direct factory representative in Ohio. His headquarters will be at 710 Hippodrome Bldg., Cleveland.

JOHN E. SLATER, formerly secretary and treasurer of the American Brown Boveri Electric Corporation, and vice-president and treasurer of the New York Shipbuilding Co., a subsidiary, has resigned to become associated with Coverdale & Colpitts, consulting engineers.

DAVID A. WALLACE, for the last 10 years general superintendent of the John Deere Tractor Co., Waterloo, Iowa, has joined the executive staff of the Chrysler Motors Corporation, Detroit. Allen H. Head, vice-president and general manager of the Deere plant, said his successor had not yet been named.

FRITZ VON OPEL, manager of the Opel Works, Russelsheim, Germany, recently arrived in the United States as the guest of Alfred P. Sloan, president of the General Motors Corporation, for the purpose of studying American methods of automobile production.

F. B. RENTSCHLER, president of the Pratt & Whitney Aircraft Co., Hartford, Conn., and the United Aircraft & Transport Corporation, was recently elected a director of the Pan American Airways and the Aviation Corporation of the Americas.

J. W. RUMELY has been appointed Chicago district sales manager, motor department, of the Ohio Electric & Controller Co., of Cleveland, effective June 1. He will be located at 333 N. Michigan Ave., Chicago.

A. E. THORNTON was elected assistant treasurer of the Skinner Chuck Co., New Britain, Conn., at a recent meeting of the board.

HENRY W. ARMSTRONG has been elected treasurer of the Joseph Dixon Crucible Co., Jersey City, in place of the late William Koester.

Obituaries

EDMUND PERKINS EDWARDS, manager of the radio department of the General Electric Co., since its organization in 1921, died at his home in Schenectady on April 27 following an illness of almost a year. He was in charge of the commercial, engineering and manufacturing activities of the radio department. Mr. Edwards was commissioned in May, 1922, as lieutenent-colonel in the Signal Officers Reserve Corps, and was assigned to the wartime procurement office of the chief signal officer. He was a member of numerous engineering and technical associations.

JAMES FREDERICK MCCLOSKEY, president and general manager of the Lincoln Machine Co., Pawtucket, R. I., died April 28, at his home in Providence. Mr. McCloskey was nationally known as an engineer and inventor, and reorganized the Remington Arms plant at Bridgeport, Conn., during the War. At various times Mr. McCloskey was also connected with the Taft-Peirce Co. and the United Shoe Machinery Company.

FRANK J. NEWBURY, 65, general manager of the insulated wire department of John A. Roebling's Sons Co., Trenton, N. J., died on April 29 at Baltimore. He had been with the Roebling company for 38 years, coming there first as a chemist and assistant superintendent to the late F. A. Perrine.

FRANK B. TOOMBS, general sales manager of the Chicago Steel and Wire Co., Chicago, died in that city on April 15. He was one of the founders of the company, being a director and treasurer at the time of his death also.

JOHN C. TALCOTT, chief engineer of the Pierce-Arrow Motor Car Co., Buffalo, N. Y., died on April 28. He was 42 years old, and a graduate of Cornell University.

LEE H. HOOK, 51, works manager for the past twenty years of the Calumet Steel Co. at Chicago Heights, Ill., died April 26 following a long illness.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Eastern Spring meeting, Rochester, N. Y., week of May 13. Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

NATIONAL ASSOCIATION OF PURCHASING AGENTS. Annual meeting, June 3-6, at Buffalo. G. A. Renard, secretary, 11 Park Place, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

The Weekly Price Guide

Rise and Fall of the Market

DECLINING trends continue in the non-ferrous metals. Copper, tin, lead, zinc, solder, babbitt and scrap are all lower than last week at principal centers. Lower prices have stimulated sales of tin, while on the other hand, volume of zinc sales is small, comparatively. Copper is quiet. Lead prices show some tendency to stabilize. Steel prices remain firm throughout the list. Sheets are up 20c. per 100 lb., this week, at Cleveland warehouses. Plates are scarce in the Chicago market. Tin plate production of several leading independents is reported at 100 per cent of capacity.

(All prices as of May 3, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	24.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.50
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20	3.35	3.25	3.90*
No. 12	2.25	3.40	3.30	3.95*
No. 14	2.35	3.45	3.35	4.00*
No. 16	2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.75	3.60	3.70	3.80
No. 22	2.90	3.75	3.85	3.95
No. 24	2.95	3.80	3.90	4.00
No. 26	3.05	3.90	4.00	4.10
No. 28	3.20	4.50	4.15	4.25
Galvanized				
No. 10	2.90	3.95	4.05	4.05
Nos. 12 to 14	3.00	4.05	4.15	4.15
No. 16	3.10	4.15	4.25	4.25
No. 18	3.25	4.30	4.40	4.40
No. 20	3.40	4.45	4.60	4.55
No. 22	3.45	4.50	4.65	4.60
No. 24	3.70	4.65	4.75	4.75
No. 26	3.85	4.90	5.00	5.00
No. 28	4.10	5.15	5.25	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

— Thickness — B.w.g. and Decimal Fractions		Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			48.00
Lead, pigs, E. St. Louis	6.82½	New York	8.25
Zinc, slabs, E. St. Louis	6.60	New York	8.50

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.50	14.25
Copper sheets, base	33.75	27.75	27.75
Copper wire, base	29.37½	20.25	19.87½*
Copper bars, base	32.25	26.25	26.25
Copper tubing, base	35.12½	29.25	29.25
Brass sheets, high, base	27.12½	23.25	23.25
Brass tubing, high, base	32.00	28.25	28.25
Brass rods, high, base	24.87½	21.25	21.25
Brass wire, high, base	27.62½	23.75	23.75

*At mill.

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	32.75	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			62.00
Commercial genuine, intermediate grade.....			46.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	11.25 @14.50	13.50	13.00 @14.00
Copper, heavy, and wire.....		13.00	12.00 @13.00
Copper, light, and bottoms	11.75 @12.25	12.50	11.00 @12.00
Heavy lead.....	5.25 @ 5.50	6.25	5.00 @ 5.50
Tea lead.....	3.75 @ 4.25	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	8.00 @ 8.50	8.00	8.00 @ 8.50
Brass, heavy, red.....		12.50	12.00 @12.50
Brass, light.....	6.75 @ 7.25	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.00 @ 9.50	9.00	10.00 @10.50
Zinc.....	3.25 @ 3.75	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†	.16	38.00 per M	.16
Sal soda, per lb.....	.02½	.02	.02
Roll sulphur, per lb.....	.02¾	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.109	.11	.113
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	.55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.24875	.24875	.165
Solder (½ and ½).....	per lb..	.3275	.3525	.3325
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.75@2.85		
Coke, prompt foundry, per net ton...	Connellsville, 3.75@4.50		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7–16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

Machine Requirements and Industrial Construction

Equipment Wanted

D. C., Washington—A. L. Flint, General Purchasing Officer of the Panama Canal—will receive bids until May 18, for air compressor, submarine hammer drill and accessories.

Ill., Springfield—Peter Vredenburgh Lumber Co., Third and Jefferson Sts.—electrically driven machinery and equipment for proposed 1 and 2 story, 157 x 340 ft. planing mill at Madison and First Sts. Estimated cost $110,000.

Mass., Boston—Hillingsworth & Vose Co., 335 Washington St.—10 ton traveling crane.

Mich., Detroit — Horton Brazing Co., 80 Horton Ave.—grinder and equipment for general work.

Mich., Pontiac — Grand Trunk Railroad Co., 400 East Jefferson St., Detroit—machinery and equipment (later) for proposed round house machine shop, etc., here.

Mo., St. Louis—Bungalow Auto Repair Co., 3700 Michigan Ave.—lathe and air compressor.

O., Euclid (br. Cleveland) — Chase Brass & Copper Co., F. S. Chase, Pres., Waterbury, Conn. —three traveling cranes for proposed second unit of plant, 1 story, 225 x 1,500 ft. Estimated cost $3,000,000.

Ore., Portland—Albina Marine Iron Works, ft. of Clark St., W. Cornfort, Pres.—electrically driven machinery and equipment to cost $50,000 to $75,000 including punchers, drills, etc. to replace fire loss.

Pa., Pittsburgh—Bd. of Education, Bellefield Ave.—will receive bids until May 15, for sensitive drill for Gladstone junior high school.

Tex., Dalhart — C. Williams—machinery and equipment for general automobile repairing for proposed 1 story, 100 x 140 ft. garage. Estimated cost $45,000.

Ont., Dundas—Jones Bros., C. W. Hunter, Gen. Mgr.—woodworking equipment for proposed 2 story, 75 x 75 ft. addition to factory on Mountain St. Estimated cost $50,000.

Ont., Elora—Elora Furniture Co., J. Walser, Prop.—complete machinery and equipment for proposed 1 story, 60 x 355 ft. factory on Main St.

Ont., Hamilton—Stanley Steel Co., H. Hatch, Mgr.—equipment for proposed addition to cold rolling plant and annealing building. Estimated cost $100,000.

Ont., Sault Ste. Marie—Bd. of Education—complete machinery and equipment for iron and wood working shops for proposed 2 story, 75 x 100 ft. technical school. Estimated cost $125,000.

Sask., Weyburn—G. Lythgoe—machinery and equipment for the manufacture of plumbers' and steamfitters' supplies, also sheet metal equipment for proposed shop.

Opportunities for Future Business

California — Nevada-California-Oregon R.R. Co., plans extensions and improvements to terminal facilities including new engine houses, etc. at Alturas and Wendel. Estimated total cost $1,000,000. W. T. Gould, Ch. Engr.

Calif., Eureka—State Highway Commission, awarded contract for the construction of maintenance shops, etc. Estimated cost $43,875.

Calif., Stockton—Fraser Gas Furnace Co., 445 South San Joaquin St., awarded contract for a 1 story factory on Fremont St. Estimated cost $40,000. Noted Mar. 21.

Conn., Bridgeport—Bridgeport Land & Title Co., 875 Main St., plans the construction of a garage on Gilbert St. Estimated cost $150,000. Architect not selected.

Conn., Hartford — Ideal Auto Body Works, 1702 Main St., awarded contract for a 2 story, 38 x 90 ft. plant on Main St. Estimated cost $40,000. Archt. Noted Mar. 14.

Conn., Waterbury — Bristol Co., Platts Mills, awarded contract for addition to factory. Estimated cost $40,000. Noted Apr. 11.

Conn., Waterbury—Lux Clock Mfg. Co., 97 Sperry St., is having plans prepared for a 4 story, 45 x 150 ft. factory on Johnson St. Estimated cost $150,000. T. M. Freney, 51 Leavenworth St., Archt.

Ill., Bloomington — Bloomington Battery Service Co., L. C. Kaler, Mgr., awarded contract for a 2 story garage and battery shops at Grove and Gridley Sts. Estimated cost $40,000.

Ill., Chicago—Elizabeth Street Foundry, 5833 South Elizabeth St., awarded contract for a 1 story, 52 x 124 ft. foundry. Estimated cost $20,000.

Ill., Chicago — W. A. Jones, Kostner and Roosevelt Aves., awarded contract for a 1 story, 100 x 130 ft. foundry. Estimated cost $15,000.

Ill., Chicago—Lindberg Steel Treating Co., 221 Union Park Court, awarded contract for a 1 and 2 story factory. Estimated cost $35,000.

Ill., Chicago—Link Belt Co., 310 West Pershing Rd., awarded contract for a 1 story, 127 x 141 ft. addition to machine shop, etc. Estimated cost $40,000.

Ill., Chicago — Nordendale Mfg. Co., 1638 North Paulina St., awarded contract for the construction of a 1 story, 72 x 121 ft. machine shop. Estimated cost $30,000. Noted Feb. 28.

Ill., East Peoria (Peoria P. O.)—Caterpillar Tractor Co., c/o M. M. Baker, Local Mgr., awarded contract for a 1 and 2 story factory. Estimated cost $750,000.

Ia., Fairfield — Lowden Machinery Co., will build a 1 story, 130 x 160 ft. addition to factory. Estimated cost $25,000.

Ill., Kewanee—Kewanee Mfg. Co., 401 Fremont St., will receive bids for a 1 story steel products plant. Estimated cost $50,000. F. B. Chase, Inc., 720 North Michigan Ave., archt. Noted Mar. 21.

Ind., Fort Wayne—Fisher Bros Co., 118-20 West Columbia St., will soon award contract for a 1 story, 70 x 150 ft. machine shop and garage at Lafayette and Main Sts. Estimated cost $45,000. A. M. Strauss, 706 Tri-State Bldg., Archt. Noted Mar. 28.

Ind., Indianapolis—Marmon Motor Co., 1101 West Morris St., awarded contract for addition to plant. Estimated cost including equipment $1,500,000.

Ind., Michigan City—F. B. Chase, Inc., 720 North Michigan Ave., Chicago, Ill., archt., is receiving bids for a 1 and 2 story factory for the manufacture of heating specialties, steam traps, etc. here for C. A. Dunham Co., 450 East Ohio St., Chicago. Estimated cost $1,000,000.

Ia., Council Bluffs — Omaha Standard Body Co., M. Standish, Pres., 2411 West Broadway, plans addition to plant. Estimated cost $25,000.

Me., Belfast — City Vulcanizing Co., c/o Edwards Sales Co., 4 Congress St., Portland, Archt., is receiving bids for a 2 story, 50 x 85 ft. repair and service garage on Main St. here. Noted Oct. 18.

Md., Baltimore—Continental Can Co., Keyser Bldg., awarded contract for a 1 story, 60 x 438 ft. addition to factory at 3500 East Biddle St.

Md., Baltimore—Port Development Comn., Lexington Bldg., awarded contract for a 1 story, 32 x 84 ft. shops, etc. at McComas St. Terminal. Estimated cost $159,575. Noted Apr. 18.

Md., Baltimore — Western Electric Co., 195 Broadway, New York, N. Y., awarded contract for the construction of a cable and insulated wire plant at Point Breeze. Estimated cost approximately $25,000,000.

Mass., Gardner — Hedstrom Union Co., 319 Main St., is receiving bids for a 3 story, 60 x 100 ft. addition to factory on Main St. A. Johnson, 16 Norwich St., Worcester, Archt.

Mass., New Bedford—Norlander Machine Co., 363 South First St., is receiving bids for a 1 story machine shop. A. L. Lucas, Smith Mills, North Dartmouth, Archt.

Mass., Springfield—Spartan Saw Works, 152 Fish Ave., will soon award contract for a 1 story, 50 x 100 ft. plant. Estimated cost $40,000. P. B. Johnson, 1562 Main St., Archt. Noted Feb. 28.

Mich., Detroit—Fisher Body Corp., General Motors Bldg., awarded contract for a 1 and 2 story automobile body plant at Farnsworth Ave. Estimated cost $40,000.

Mich., Detroit — Thompson Aeronautical Corp., Riverside Dr., Cleveland, O., awarded contract for a 60 x 100 ft. sea plane terminal including shops for emergency repairs to amphibian planes. Estimated cost $50,000.

Mont., Laurel — Northern Pacific Ry. Co., Railroad Bldg., St. Paul, Minn., awarded contract for the construction of 100 x 250 ft. car repair shops here. Estimated cost $100,000. Noted Apr. 4.

N. J., Asbury Park—L. T. Lepsey Inc., 807 Sommerfield Ave., will build a 2 story, 70 x 100 ft. garage. Estimated cost $150,000. V. J. Eck, 12 Broad St., Red Bank, Archt. Noted Mar. 21.

N. J., Elizabeth—Bd. of Commissioners, City Hall, will receive bids about May 15, for a 2 and 3 story, 60 x 150 ft. police headquarters building including machine shop, etc. at Morell and Catherine Sts. Estimated cost $250,000. L. Quien, Jr., 229 Broad St., Archt.

N. J., Jersey City—J. Goldenberg, 80 Woodland St., Englewood, is having plans prepared for a 3 story, 150 x 230 ft. garage, etc. at Sip and Summit Aves. Estimated cost $500,000. C. Shilowitz, 26 Journal Sq., Jersey City, Archt. Noted Apr. 18.

N. J., Jersey City—Milrog Construction Co., J. Levine, 54 Hudson Pl. Weehawken, is having plans prepared for the construction of a 2 story, 100 x 200 ft. garage on Montgomery St. Estimated cost $150,000. C. Shilowitz, 26 Journal Sq., Archt.

N. J., Newark—Herpers Bros., 18 Crawford St., is having plans prepared for a 2 story addition to jewelry factory at Washington and Crawford Sts. Estimated cost $40,000. E. A. Wurth, 207 Market St., archt.

N. Y., Long Island City—18th Ave. Building Corp., 463 7th Ave., New York, will build a garage at Haight St. and Sanford Ave. Estimated cost $200,000. Shampan & Shampan, 188 Montague St., Brooklyn, Archts.

N. Y., New York—Bethbert Realties Inc., A. Gerhardt, Pres., 1194 Randall Ave., will build a garage at Leggett Ave. and East Barry St. Estimated cost $40,000. R. Shurtlund, 147 4th Ave., Archt.

N. Y., New York—Ross Realty Corp., M. Rosen, Pres., 1045 East 27th St., plans an 8 story, 50 x 155 ft. garage at 17-19 East 12th St. Estimated cost $200,000. Seelig & Finkelstein, 66 Court St., Brooklyn, archts.

N. Y., Rockaway—Cushman's Sons, Inc., 200 West End Ave., New York, will receive bids about May 15 for the construction of a garage and repair shops at Rockaway Beach and Brandreth Ave. Estimated cost $65,000. R. F. Jacobus, 511 6th Ave., New York, archt.

O., Akron—Burns Motor Co., 68 West Exchange Pl., plans the construction of a garage at Exchange and Locust Sts. Estimated cost $150,000.

O., Cleveland — Ohio Crankshaft Co., 6600 Clement Ave., awarded contract for a 1 story, 35 x 119 ft. factory at 6502 Park Ave. Estimated cost $12,000.

O., Euclid — Cleveland Trencher Co., 20100 St. Clair Ave., awarded contract for a 1 story, 60 x 80 ft. addition to factory. Estimated cost $40,000.

Pa., Homestead—A. G. Wickerham, 135 East 8th Ave., Archt., is receiving bids for a 3 story, 130 x 240 ft. plant for Standard Propeller Co. Estimated cost $250,000. Noted May 2.

Pa., Philadelphia — Brown Instrument Co., Roberts and Wayne Sts., awarded contract for a 2 story, 79 x 219 ft. plant. Noted Apr. 25.

Tenn., Memphis—U. S. Engineer Office, Ware Dept., plans the construction of a shop and warehouse at Supply and Repair Depot on West bank of Mississippi river opp. here.

Tex., Lubbock—City voted $75,000 bonds for the construction of a municipal airport including hangars, machine and repair shops, etc.

B. C., Vancouver—Boeing Aircraft Ltd. of Canada, H. Hoffar, Pres., plans the construction of an aeroplane factory. Estimated cost $200,000.

Ont., Toronto—Dominion Wheel & Foundries, 131 Eastern Ave., is having plans prepared for addition to foundry on Eastern Ave. Estimated cost $60,000.

Ont., Toronto—A. D. Gorrie & Co., 354 Victoria St., is having plans prepared for a 2 story, 100 x 104 ft. garage on North Yonge St. Estimated cost $200,000.

Sask., Nakomis—R. N. Priess, plans addition to factory for the manufacture of sash and doors.

Ont., Walkerville—Trussed Concrete Steel Co., Walker Rd., awarded contract for a 1 story, 100 x 200 ft. plant. Estimated cost $75,000.

Ont., Windsor — Bryant Pattern & Mfg. Works, 201 Glengarry Ave., awarded contract for a 1 and 2 story pattern and machine shop. Estimated cost $75,000.

Ont., York—Ferrante Electric Co., 26 Noble St., Toronto, is having plans prepared for a 110 x 400 ft. electrical manufacturing building. Estimated cost $200,000. Ewart, Armer & Byam, 36 Toronto St., Toronto, Archts.

Que., Buckingham — Telesphore Damphouse, plans the construction of a planning mill. Estimated cost $35,000.

American Machinist

A McGRAW-HILL PUBLICATION . . . ESTABLISHED 1877

MAY 16, 1929

WHAT OBSOLETE EQUIPMENT COSTS

TO HENRY FORD is attributed the statement that the cost of keeping obsolete equipment in use should be measured by the difference in the relative costs of producing a part on the old equipment and on the new equipment that should replace it. The statement sounds perfectly obvious, but it is surprising to find out how few users of metal-working equipment know how much it is costing them to keep on with their present methods. The ones who do know have very little equipment that is not thoroughly modern.

In the series of articles of which this one is the first, the editors of the *American Machinist* propose to show by specific examples, just what it costs to keep obsolete equipment in service, and how simple it is to figure that cost. They recognize that some men will prefer the easiest arithmetic that can be devised, and that others will want as complete a formula as economics can produce. They will therefore apply to each example three formulas of varying complexity so that the reader may take his choice. The results will differ somewhat, but the unescapable conclusion is that obsolete equipment is expensive

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The plan on which the series is based contemplates the preparation of one article for each of the major markets for metal-working equipment, and one for each of the principal auxiliary or contributory processes, such as materials handling. The first market to be considered is the railroad repair shop, a particularly important one because of the large proportion of obsolescence in the equipment.

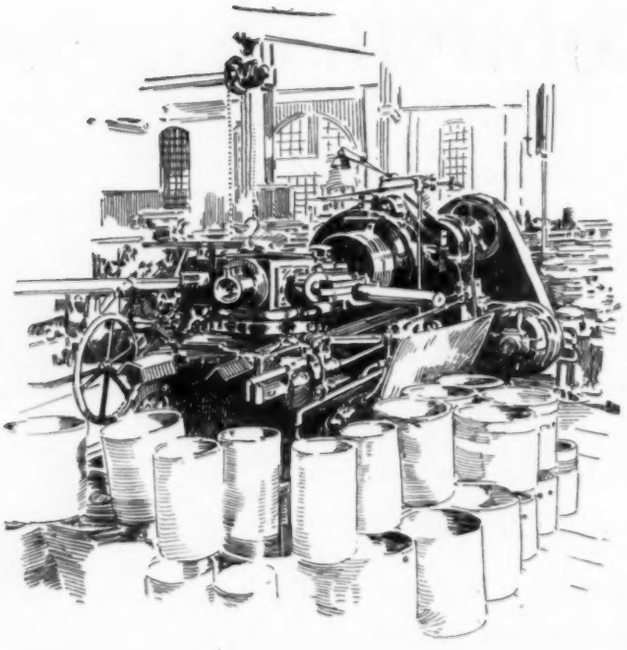
WHAT IT COSTS

to Keep

OBSOLETE EQUIPMENT

in a Railroad

Repair Shop



BECAUSE of the unfortunate fact that tradition has condemned the repair shops of a railway system to the fate of being looked upon as necessary evils, but little progress has been made toward putting equipment replacement on a sound business basis. Many a requisition for a much-needed machine has been turned down because of the fallacious idea that the purchase of a highly productive unit is not justified unless that unit can be kept constantly busy, a situation that is the exception rather than the rule in a railroad shop. The reasonable attitude to take, of course, is that the cost per piece should be the deciding factor. If the new equipment, regardless of how often it is used, produces work more cheaply it should be installed to replace the obsolete unit or units that can no longer compete.

In the series of articles published under the general heading, "Getting the Most Out of Your Machine Tool Dollar," the *American Machinist* presented the principles adopted by the most progressive executives in the metal working industry for dealing with their production equipment. Then a survey was made to discover how much obsolete equipment was actually being used. The results were not very complimentary to the railroad shops, among others. A different angle was taken in the series, "What Modern Equipment Has Done." Here the actual results obtained through the replacement of obsolete units were shown in detail.

Now, it is proposed to show just how much it is costing industry to keep on using obsolete equipment. It would be a practical impossibility, of course, to try to establish gross figures for an industry, or for the country as a whole. What can be done, however, is to give several specific instances from each branch of the industry, and then let the reader make his own estimate as to the size of the total bill for obsolescence.

As stated in the foreword of the preceding page, three formulas will be applied to each case so that the reader may select the one that is best suited to his own situation and habit of thought.

The simplest formula is that used by the Warner & Swasey Company to determine the net profit accruing through the installation of a new piece of production equipment. It is widely applicable and was chosen after 24 other formulas had been studied and discarded.

Next in complexity comes the formula worked out at the Hess-Bright plant of SKF Industries, and described in detail in an article in the *American Machinist* by Robert F. Runge, vice-president in charge of production, Vol. 62, No. 19. In this company all the superintendent of a plant has to do in order to get a requisition approved is to show by the formula that the equipment asked for will pay for itself within a given period, usually two years.

Finally, the formula developed by the American Society of Mechanical Engineers will be applied. It contains more factors than the others and is somewhat more complicated, but it can be used by any one with ordinary intelligence and gives satisfactory results.

What It Cost to Machine Steam Chest Bushings on an Old Machine

The first case to be considered is that of a turret lathe. It was requisitioned by the superintendent of a shop on a railroad that shall be nameless. The job was the rough machining of steam chest bushings, 15½ in. O.D. The material was gun iron. With the existing equipment the time per piece was 180 min. Based on performance records of essentially similar jobs in other railroad shops it was conservatively estimated that the time per piece

on the new equipment asked for would be 40 min. per piece.

* * * * *

Now, according to the Warner and Swasey method, labor cost is assumed to be 60 cents per hour and overhead 90 cents per hour, which works out to 2½ cents per minute for both. Therefore:

Former cost per piece = 180 × 2½ cents	= $4.50
Estimated cost per piece = 40 × 2½ cents	= 1.00
Gross saving per piece	= $3.50

Using a 48-min. hour (to allow for emergencies, operator being away from machine, etc.) and an 8-hour day, the gross saving per year of 280 working days would be

9½ (pieces per day) × 280 × $3.50	= $9,310.00
Cost of turret lathe complete	= $7,324.50
Cost of special tooling	= $ 300.00
Total investment	= $7,624.50

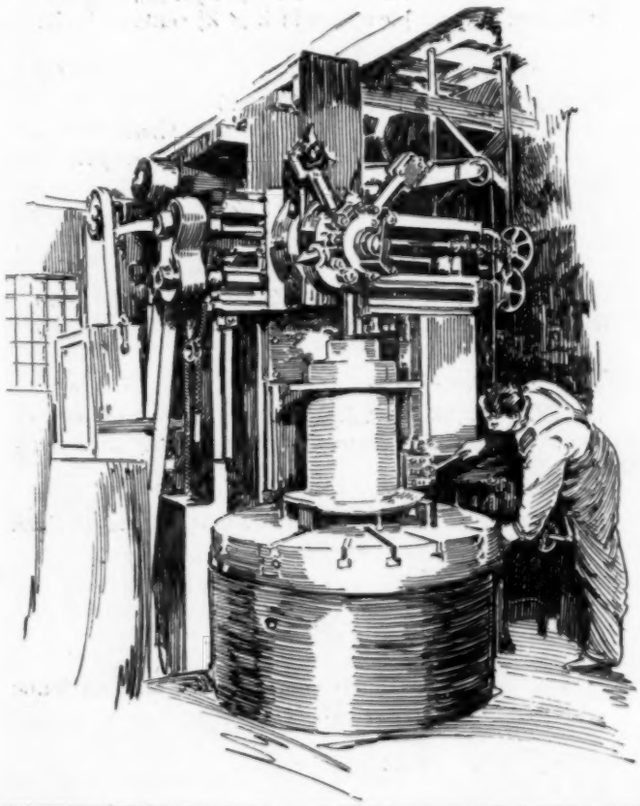
Depreciation on the investment

20 per cent on machine and standard equipment	= $1,449.00
100 per cent on special tooling	= $ 300.00
Total depreciation	= $1,749.00
Gross savings — depreciation	= $7,561.00

And that figure, according to this method of estimating, is what it cost the railroad company per year when the superintendent's requisition was disapproved.

* * * *

But let's see how the picture looks if we use the replacement formula of the SKF organization. Here we have to do a little juggling because the formula was designed to determine the number of months in which a proposed installation would pay for itself.



The formula is this:

$$M = \frac{C_E + C_T + C_{IX} + C_{DX} + V_B}{(R_P - R_E)N_D D_M + S_{OHM}}$$

in which:

M = the number of months in which the equipment will pay for itself
C = the cost of the new equipment to be installed
C_T = the cost of tooling the new equipment
C_{IX} = the cost of interest for X years at 6 per cent, X equaling the number of years determined upon as the maximum time during which the equipment must pay for itself
C_{DX} = the cost of depreciation for X years at 10 per cent, X having the same value as above
V_B = the book value of the displaced equipment
R_P = the present rate (cost) per piece
R_E = the estimated rate (cost) on the new equipment
N_D = the number of pieces to be produced per day on the proposed equipment
D_M = the number of working days per month
S_{OHM} = the savings in overhead per month

In our case let us assume, as before, that the new equipment is to be written off in five years, and that the equipment to be replaced has a book value of $500. Then

C_E = $7,324.50
C_T = $300.00
C_{IX} = $2,197.35 (Interest at 6 per cent for 5 years)
C_{DX} = $3,662.25 (Depreciation at 10 per cent for five years)
V_B = $500.00
R_P = $4.50
R_E = $1.00
N_D = 9.5
D_M = 24
S_{OHM} = 0 (Included in calculation of rate per piece)

Then, M =

$$\frac{\$7,324.50 + \$300 + \$2,197.35 + \$3,662.25 + \$500}{\$3.50 \times 9.5 \times 24 + 0}$$

$$= \frac{\$13,984.10}{798}$$

= 17.5 months

If the new equipment pays for itself in 17½ months then it must have made savings during that period equal to its original cost, or $7,624.50. But we have assumed that the investment is to be written off in five years. It seems fair to assume, therefore, that the savings per month will be $\frac{\$7,624.50}{17.5}$ or $436, and that over the whole five-year period the total saving will be $436 × 5 × 12 = $26,160. To get a figure comparable with that given by the Warner and Swasey formula we should divide this sum by five to get the savings per year, or $\frac{\$26,160}{5}$ = $5,232, or a loss of that amount if the equipment is not installed.

According to the SKF formula, then, we do not get so large an estimated loss, but what we do get is still

quite large enough to make any railroad management sit up and take notice.

* * * *

But now let us get at the case from still a different angle, using the somewhat more complicated formula developed by a committee of the American Society of Mechanical Engineers. These are the definitions of the symbols used:

A = interest rate, or yearly allowance on investment
B = yearly percentage allowance for insurance, taxes, etc.
C = yearly percentage allowance for upkeep
E = yearly cost of power, supplies, etc., in dollars
h = expected number of years of life of equipment
I = initial cost of new equipment, in dollars
K = unamortized value of equipment displaced, less its scrap value, in dollars
X = percentage of year during which equipment will be in use
S = yearly saving in direct labor cost, in dollars
T_a = yearly saving in labor burden, in dollars
T_b = yearly fixed charges on old equipment, in dollars
U = yearly saving or earning through increased production, in dollars
Y = yearly cost to maintain new equipment ready for operation, in dollars (fixed charges)
V = yearly net operating profit from new equipment, in excess of fixed charges, in dollars.

In our case the symbols have the following values:

$A = 0.06 \quad B = 0.01 \quad C = 0.05$
$E = 0 \quad h = 5$
$I = \$7{,}624.50$
$K = \$500$
$X = 0.93$
$S + T_a = \$9{,}310$
$T_b = \$600$
$U = 0$

The formula for

$$Y = I\left(A + B + C + \frac{1}{h}\right)$$

$$= \$7{,}624.50\ (0.06 + 0.01 + 0.05 + \tfrac{1}{5})$$
$$= \$7{,}624.50 \times 0.32 = \$2{,}440$$

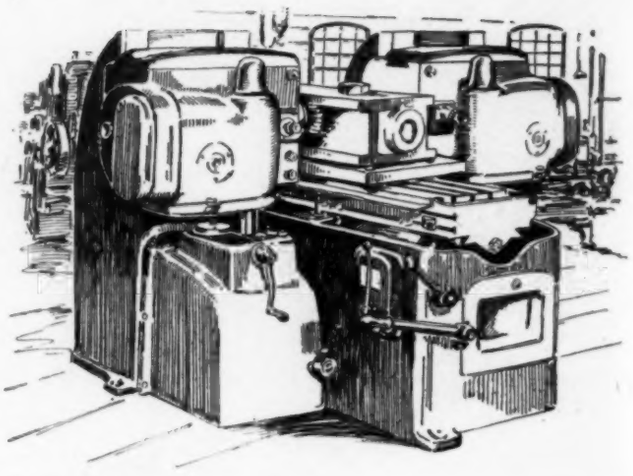
$$V = [(S + T_a + U - E)\,X + T_b] - \left[Y + K\left(A + \frac{1}{h}\right)\right]$$
$$= [(\$9{,}310 + 0 - 0)\ 0.93 + \$600] - [\$2{,}440 + \$500\ (0.06 + 0.20)]$$
$$= \$6{,}970.$$

Obviously, if this sum is the net profit to be expected from the installation of the new equipment, it is just as logically the price to be paid out of profits for keeping the old equipment in service.

So much for the first example. Let us look at another one.

What It Costs to Mill a Crosshead on Obsolete Equipment

In the same shop a standard No. 5 milling machine was in use for milling the jib or guide bearings of a locomotive cross head for the babbitt lining. The piece was a steel forging and time per piece for rough and



finish milling, using a shell end mill, and mounting the piece on a stud through the bored hole in the crosshead, was 75 minutes.

The superintendent wished to replace this method by one employing a duplex miller equipped with an indexing fixture and using two shell end mills cutting simultaneously. The time estimate per piece, based on experience with similar jobs, was 11.2 min. The cost of the machine was $7,000, and of the fixture, $1,925. The cost of the combination gave the financial authorities heart failure and the requisition for the new equipment was disapproved. Let's see what the lack of vision cost, as indicated by our three formulas.

* * * *

Taking the Warner and Swasey formula first, we have:

Former time per piece	= 75 min.	
Estimated time per piece	= 11.2 min.	
Former cost per piece	= 75 × 2½ cents	= $1.88
Estimated cost per piece	= 11.2 × 2½ cents	= $0.28
Gross saving per piece		= $1.60
$1.60 × 280 × 34.3	= $15,350	
		= Gross saving per year
Cost of new machine	= $7,000	
Cost of fixture	= $1,925	
Total investment	= $8,925	
Depreciation on machine	= 0.20 × $7,000	= $1,400
Depreciation on fixture	= 1.00 × $1,925	= $1,925
Total depreciation		= $3,325

$15,350 — $3,325 = $12,025 = net saving per year, or the cost to the management because of not approving the purchase.

* * * *

And now, what does the SKF formula indicate? The values for the symbols are:

$C_E = \$7{,}000$
$C_T = \$1{,}925$
$C_{IX} = \$2{,}100$
$C_{DX} = \$3{,}500$
$V_B = \$1{,}000$ (Book value minus trade-in value of $1,500)
$R_P = \$ \quad 1.88$
$R_E = \$ \quad 0.28$

N_D = 34.3
D_M = 24
S_{OHM} = 0 (Included in calculation of rate per piece)

$$\text{Then, } M = \frac{7{,}000 + 1{,}925 + 2{,}100 + 3{,}500 + 1{,}000}{1.60 \times 34.3 \times 24 + 0}$$

$$= \frac{15{,}525}{1317.1} = 12 \text{ months.}$$

By the same reasoning as in the other case we reach the conclusion that, as the equipment would pay for itself in one year, the cost to be charged against the profits for not putting it in would be equal to the original investment, or $8,925.

* * * *

Applying the A.S.M.E. formulas as in the preceding case we have for the values of the symbols:

$A = 0.06$ $B = 0.01$ $C = 0.05$
$E = 0$ $h = 5$
$I = \$8{,}925$
$K = \$1{,}000$
$X = 0.93$
$S + T_a = \$15{,}350$
$T_b = \$1{,}500$
$U = 0$

Then, $Y = \$8{,}925\ (0.06 + 0.01 + 0.05 + 0.20)$
$= \$8{,}925 \times 0.32 = \$2{,}855$
$V = [(8{,}925 + 0 - 0)\ 0.93 + \$1{,}500)] - [\$2{,}855 + \$1{,}000\ (0.06 - 0.20)]$
$= \$8{,}300 + \$1{,}500 - \$3{,}115$
$= \$6{,}685.$

Here again we get a more conservative figure than by the simpler formulas, but still a decidedly imposing one.

Loss Occasioned by Using an Old Machine on Piston Work

As a final example, let us consider the figures involved in the replacement of an old-fashioned boring mill by a modern vertical turret lathe. Both machines handle more than one job but the ratios of performance on the various jobs were so near alike that it seems fair to take one job and assume that the results determined from it will apply throughout.

The job chosen is a locomotive piston of the solid type, 28 in. in diameter and 7 in. thick. On the old equipment the production time was 8 hr., on the new equipment the estimate called for 3 hr. The cost of the new lathe was $6,000. There was no special tooling.

* * * *

According to the Warner and Swasey method the cost of failure to put in the new equipment works out like this:

Former time per piece = 8 hr.
Estimated time per piece = 3 hr.
Former cost per piece $= 8 \times 60 \times 2\frac{1}{2}$ cents = $12.00
Estimated cost per piece $= 3 \times 60 \times 2\frac{1}{2}$ cents = $4.50
Gross saving per piece = $7.50

$\$7.50 \times 280 \times 2.135$ = $4,480 = Gross saving per year
Cost of machine = $6,000
Cost of tooling = 0
Depreciation on machine = $1,200
$4,480 - $1,200 = $3,280 = cost of not installing new equipment.

* * * *

For applying the SKF formula we have these values for the symbols:

$C_B = \$6{,}000$
$C_T = 0$
$C_{IX} = \$1{,}800$
$C_{DX} = \$3{,}000$
$V_B = \$\ 300$ (Book value minus trade-in value of $200)
$R_P = \$\ 12$
$R_B = \$\ 4.50$
$N_D = 2.135$
$D_M = 24$
$S_{OHM} = 0$ (Included in calculation of rate per piece)

$$\text{Then, } M = \frac{6{,}000 + 0 + 1{,}800 + 3{,}000 + 300}{7.50 \times 2.135 \times 24 + 0}$$

$$= \frac{11{,}100}{384} = 29 \text{ months.}$$

Since the new equipment would have paid the purchaser $6,000 in 29 months he is out $\frac{12}{29}$ of $6,000 or $2,500 each year.

* * * *

Turning now to the A.S.M.E. formula we have:

$A = 0.06$ $B = 0.01$ $C = 0.05$
$E = 0$ $h = 5$
$I = \$6{,}000$
$K = \$\ 300$
$X = 0.93$
$S + T_a = \$7.50$
$T_b = \$250$
$U = 0$

Then, $Y = \$6{,}000\ (0.06 + 0.01 + 0.05 + 0.20)$
$= \$6{,}000 \times 0.32 = \$1{,}920$
$V = [(\$6{,}000 + 0 - 0)\ 0.93 + \$250] - [\$1{,}920 + \$300\ (0.26)]$
$V = \$5{,}580 + \$250 - \$1{,}998$
$= \$3{,}832.$

In applying these formulas to railroad shop examples several assumptions have been made that will probably be questioned by executives in shops where the rates of pay are different from those assumed. Percentage of overhead as assumed will be open to the same question. And others will wonder why a railroad shop tool should be expected to pay for itself in five years.

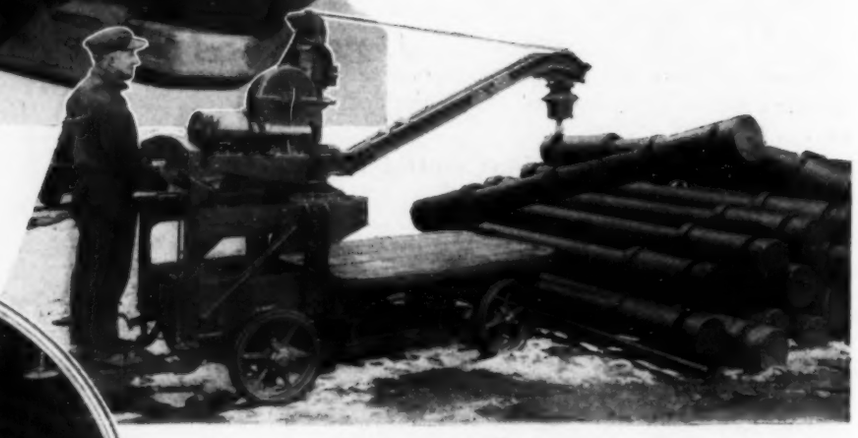
The only answer to these objections is that the rates and amounts assumed were chosen for the sake of uniformity in applying the formulas. It was found impossible to secure all the detailed data needed and assumptions were therefore necessary. In any event, the assumptions are such that the validity of the principle is not involved.

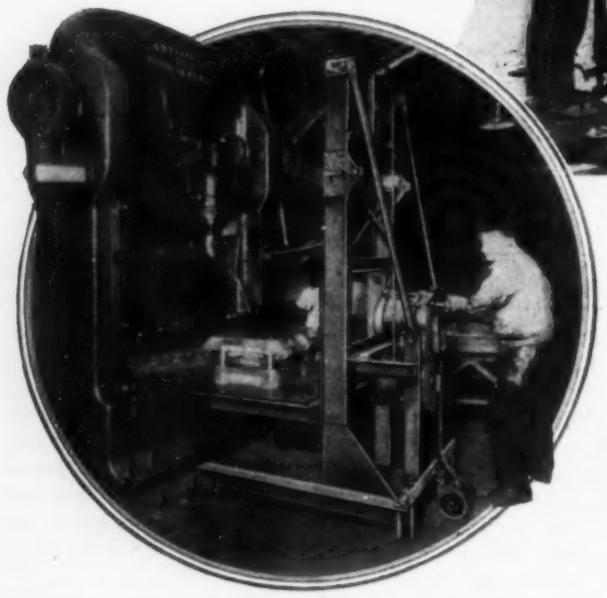
The editors of the *American Machinist* are convinced that any purchaser of metal-working equipment who will apply these formulas, or any of them, to his own problems where he has all the detailed data will be impressed by the cost of keeping on with equipment that is obsolete.

MECHANICAL EQUIPMENT

in Metal-

The all-round serviceability of the industrial lift truck is demonstrated by the fact that over 110,000 electric and hand lift trucks and 9,000,000 skid platforms are in use in American plants. They offer special economies in the metal-working field. One large machine-tool plant employs heavy-duty trucks of the type pictured to handle machinery in all stages of manufacture. . . . Automatic Transportation Company, Inc.





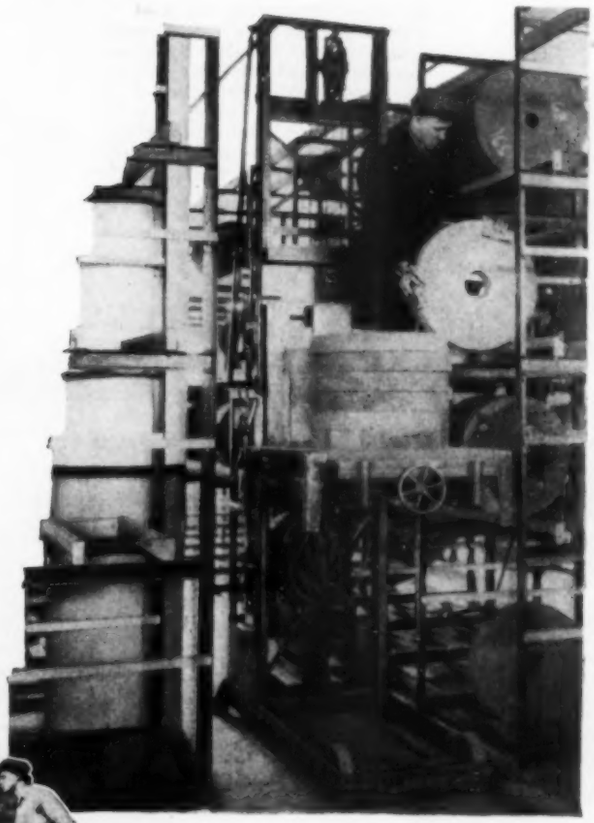
In forge shops and sheet-metal shops, heavy dies are cheaply and conveniently moved to and from storage shelving, and on and off of presses, all in one handling, by electric elevating trucks. . . . Barrett-Cravens Company.

The electric lift truck is adapted to many special jobs by the addition of a wide variety of auxiliary devices. Heavy weights are conveniently lifted by crane attachments, the one shown in the photograph handling 1,200-lb. axles. . . . Crescent Truck Company.

Electric tractors and trailers are particularly adapted to internal transportation service, organized under a regular scheduling and dispatch system, as well as to miscellaneous handling operations. A prominent firm manufacturing hardware and fittings employs them to handle castings from foundry to machine shop. . . . Mercury Manufacturing Corporation.

Cuts the Cost of Handling

Working Plants



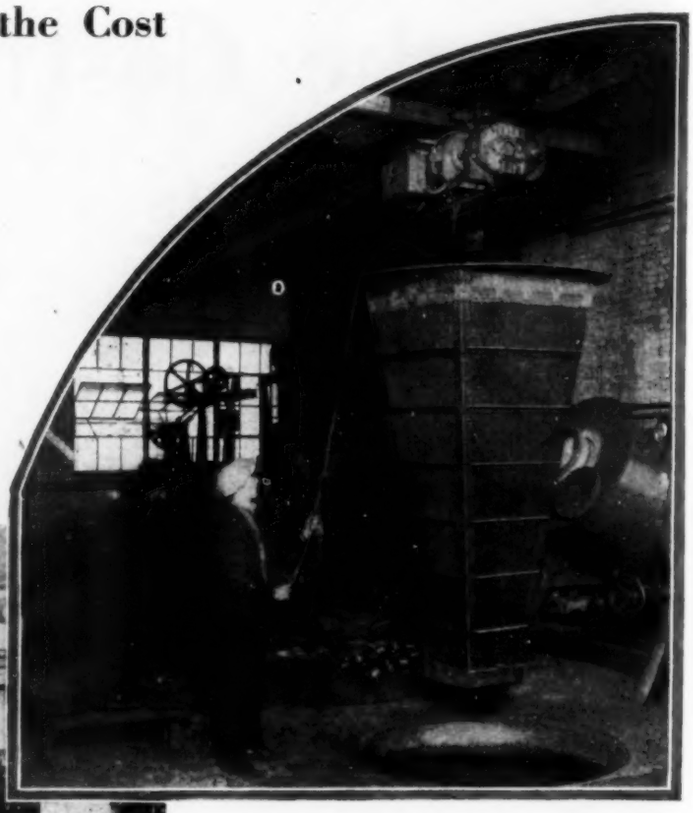
Where high lifting is required, or similar difficult handling operations are to be performed, an electric high-lift truck, or portable elevator, often solves the problem most satisfactorily. Such machines are of special service in close quarters, and in places like storerooms and toolrooms where heavy materials or parts must be stacked, or placed on high shelves. When not engaged in such service the equipment, since it is mobile, can be employed for other handling operations around the plant. The machine pictured, a jacklift, has elevated a load of emery wheels to a level with the storage shelves and the operator is unloading them. . . . Lewis-Shepard Company.

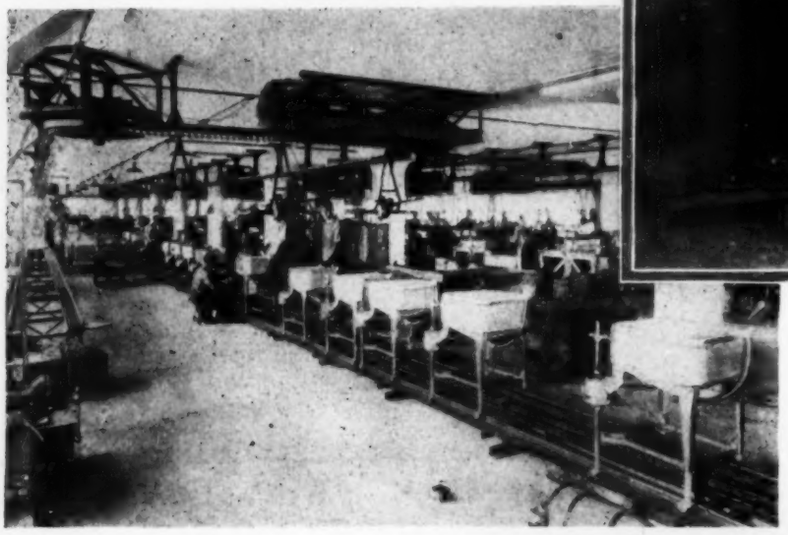
Special arms enable this Hy-Lift truck to pick up and move heavy cans of pipe fittings with the greatest facility. . . . Baker-Raulang Company.

Hand lift trucks are particularly serviceable in metal-working plants through the availability of an endless variety of special lift platforms, containers, or racks. . . . Stuebing Cowan Company.

Mechanical Equipment Cuts the Cost

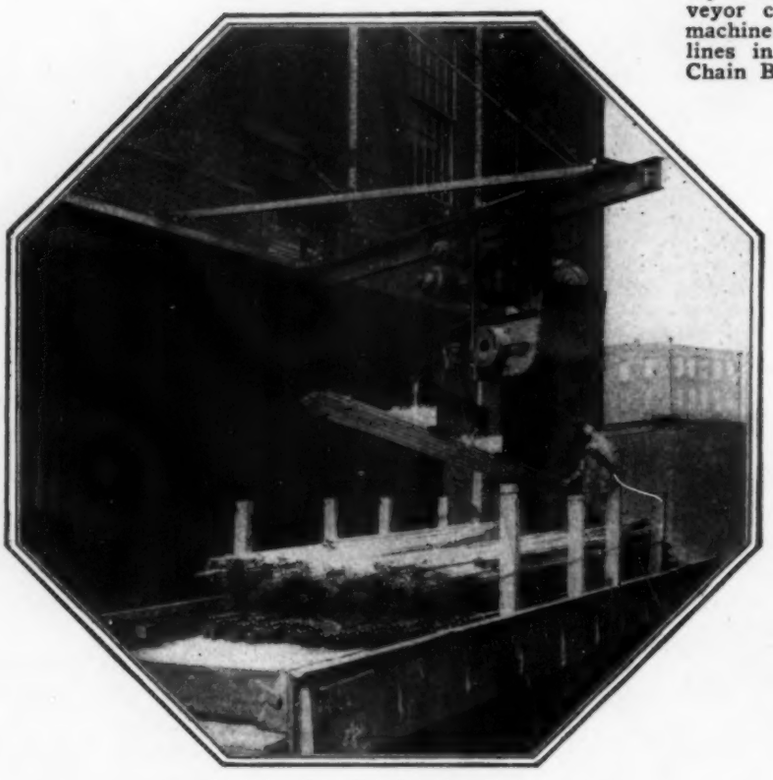
For local service a hand-operated traveling crane is often the most economical equipment to install. Such devices are available in capacities for either light or heavy handling, and have found a wide application in foundries, forge shops and heat-treating departments. The crane portrayed is carrying a wire basket, loaded with heat-treated gears, from a quenching tank to a sand blast. . . . Louden Machinery Company.





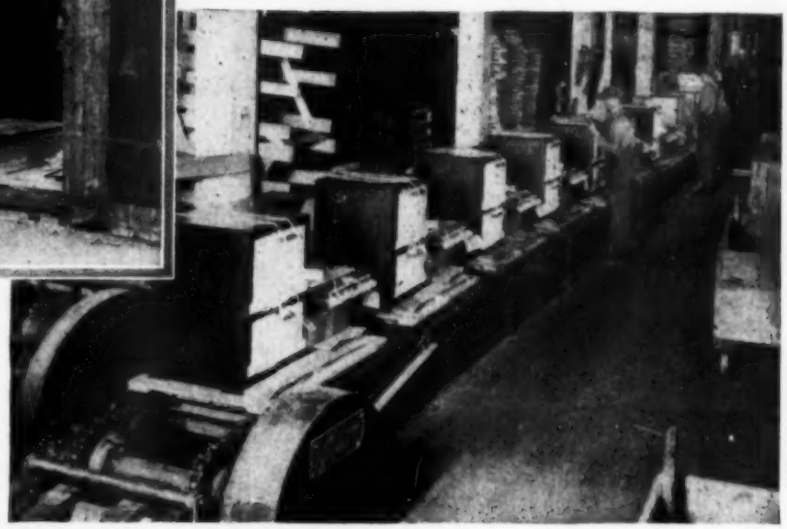
One of the most important factors in designing a material handling installation is correct selection of individual types of equipment that will co-ordinate into an economically functioning whole. In this washing-machine plant an overhead conveyor feeds parts to operators working on a floor-type assembly conveyor. Many other conveyor combinations serve the machine shops and sub-assembly lines in this same plant. . . . Chain Belt Company.

The monorail hoist provides an overhead handling system of ample capacity, covering long or short distances and wide areas, possessing great flexibility, such as turning short-radius curves and switching to different overhead tracks, or to runways on traveling cranes, and brings the operator close to his work. The hoist shown unloads pipe from car to storage, and reclaims it later for shipment. . . . Shepard Electric Crane & Hoist Company.

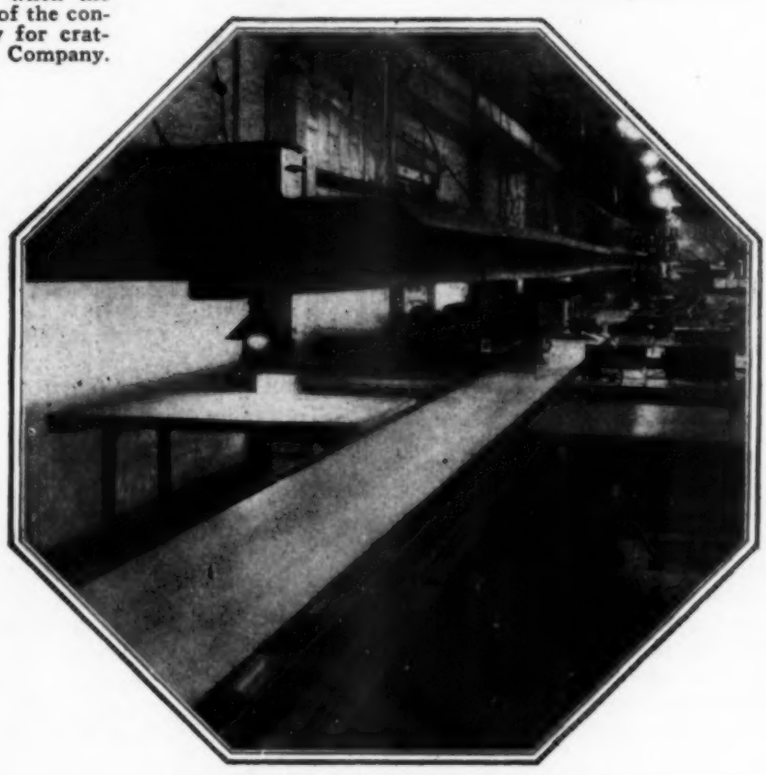


# of Handling in Metal-Working Plants

Where handling operations follow fixed routes or are performed as a local service to definite machines and equipment, a monorail carrier is an economical and efficient device to install. It is inexpensive, occupies no floor space, costs little to maintain, seldom needs repairs, and, with a hand-operated hoist, requires no power connections. Heavy loads can be handled with little effort, if the equipment is well lubricated. . . . Reading Chain & Block Corporation.



Conveyor systems have found a most extensive application in the manufacture and assembly of metal products. Gas ranges are assembled on the chain-operated slat conveyor in the accompanying picture. They are then mounted on wood bases, attachment parts are wrapped and fastened in place, doors are tied, and, when the ranges reach the end of the conveyor they are ready for crating. . . . Chain Belt Company.



In assembly work on small manufactured products the belt conveyor is commonly employed to carry parts from operation to operation. Not only is it a safe and efficient mechanism for the purpose, but also it affords a means of production control through regulating rate of travel to suit the requirements of the work. The conveyor in the illustration is installed in a radio factory. . . . Mathews Conveyer Company.

EXECUTIVE · FORUM

Net Results—Not First Cost

THE Young Manufacturing Company was having a session with the salesman for one of the new cutting alloys—which we can call super-tools, so as to avoid names or classes. Hawley, the production man, wanted to try several of the new tools on special jobs.

"But look at the price, Hawley! You don't want us to spend a young fortune for a few cutting tools do you?" asked Harry Young, the manager.

"I don't want you to *spend* a cent, Mr. Young. All I ask is that you *invest* a few dollars in tools that will probably save more than their cost in the first month. You have just put in the best typewriters you could buy. Why didn't you save money by buying the cheapest or even second-hand machines?"

"It doesn't seem quite the same, Hawley. Here you're asking me to buy new tools at an outrageous price to save a little machining time in the shop. I can't see paying forty dollars for a single small cutting tool when we can buy good steel for less than a dollar a pound. What do you think about it, Holland?" said Young turning to the counsellor-at-large.

"I'd rather hear Hawley tell his side of the story first, Harry. So far, he's got you on the run, but I'd be glad to see just what he has in mind."

"Well," continued Hawley, "I've got several jobs where I'm sure these new tools will make a good showing. I know they cost a lot of money, but I also know they'll save money in the end."

"Will these new tools cut ten times as fast as the old ones, Hawley?" broke in Young. "Unless they do they certainly can't pay for themselves. If it was only two or three times as much I could stand it, but forty dollars for a single lathe tool seems like throwing money away."

"There's something wrong with your slide rule Mr. Young, if you think the new tool must b speeded up in proportion to the cost. Even if the tools would stand ten times the speed, and they might on some work, we haven't a machine in the shop that I'd dare run at even double its present speed. You only figure on one item of the saving the new tools make possible. You overlook the very important item of idle time of the machine while the present tools are being changed and ground."

"But that can't amount to much, Hawley. It doesn't take long to grind tools, and you can have a new set ready to slip in place."

"You don't appreciate, Mr. Young, how much time it takes to reset tools after the first piece, or first few pieces, are spoiled before the reground tools are adjusted. Then too, with these new tools, when they don't need resetting nearly so often, we can cut out some inspection and one man can turn out a lot more good pieces per day, even at the same cutting speed."

"Doesn't sound reasonable to me yet, Hawley. I can't just see how a little saving in grinding can warrant the high price of these new tools. Have you had any experience with them, Holland?"

"I've been watching the new cutting tools very closely, Harry," replied Holland, "and it's an eye-opener to those who remember the tools of even twenty-five years ago. Hawley is dead right about the advisability of trying them on some of your work. And they don't have to do ten times the work of the old tools to pay handsomely.

"One of the things I can't understand, Hawley, is how you managers are so apt to think in one-track ruts. It's much like feeling you are robbed every time a piece worker jumps his output beyond what you thought he could do. You entirely overlook the fact that you are getting more output from your investment in equipment and in floor space, light, heat, insurance and other things."

"But how much can you increase cutting speed? That's what interests me most. That's something I can see," replied Young.

"Well, Harry, I'll tell you of two cases I know One hasn't increased speed any because his machines won't stand it, but his finishing tools keep their size about five hundred times as long as the old ones. This means there's no 'down' time for grinding or setting, and no spoiled work while the tools are being adjusted. You ought to be able to see what that means to production without increasing the speed. I know of another case where the speed has been greatly increased, but where the net saving is probably no more than in the first case.

"The trouble is, Harry, that you managers unconsciously think in 'dollars-per-pound' on a lot of things when you ought to think in broader terms of 'net results.' And net results include a lot of things besides the first cost of either a machine or the tools it uses."

Executives are invited to discuss the problem involved in the foregoing case. They are also urged to use this department to air their own problems. A letter to the Executive Forum Editor is all that is needed.

Discussion

Can Shop Loss Be Charged to Sales?

There is straight logic in the production man's idea that certain kinds of losses should be charged to the sales department instead of to the cost of production of money-making products. Each department should be made to stand the cost for which it is responsible. The production man of the Lewis company rightly objects to having something charged to him that is due to sales policy, and has nothing to do with his management of the shop in producing goods of a profitable nature.

It should be the same with engineering costs. There is a clear distinction between engineering costs of several kinds. First is the engineering cost of new products. This is not a part of the cost of present production and should not be charged to overhead. Second, is the cost of engineering special jobs for which the customer should be charged direct. Third, is the general engineering cost of keeping the line of production going, making minor improvements, etc. This is real overhead. Fourth, is another engineering cost that is entirely a sales cost, such as making up sales proposals and forms. This should be charged to the sales department and should not be figured in the overhead of the manufacturing department.

All these engineering costs should carry the proper amount of burden for light, heat, taxes, floor space, interest, etc., that are allocable to the engineering department. These should not be charged to the production department as a whole, as is frequently done. Why not let each function of a business bear its proper share of the costs for which that particular function is responsible?

—Ernest F. DuBrul, *General Manager, National Machine Tool Builders' Association.*

Rules—and When to Break Them

Rules, such as regulations, routine methods, specifications, and similar forms of standardized procedure, adapted to suit the individual circumstances, are as necessary in the shop as is manufacturing equipment. Once established, they should be mandatory until changed by the management. Employees cannot be permitted to break them at their discretion.

In general, rules established for one department must harmonize with those for every other department. Each division, while functioning independently, will then dovetail in with all others, and confusion and conflict will be avoided.

However, rules must not be so inflexible that proper exceptions cannot be made to them for the definite benefit of the organization. The master of a ship changes the course of his vessel to avoid storms and disasters, and to meet unusual conditions which have arisen. A similar policy is necessary for the shop. But to break a rule without proper authority is disastrous to shop discipline.

Outside of rules for the general conduct of the business, the fewer regulations one has, the better. Employees do not favor reading and remembering a long list of rules governing almost every move they make, and a well-governed shop does not require this of them. If the foreman is a capable executive he will control shop deportment, and the men will respect his wishes without the support of endless regulations.

—C. L. Anderson, *Methods Engineer, Western Electric Company, Inc., Emeryville.*

Getting Men from Other Industries

Bill Holland struck the keynote when he specified "horse sense." Ability to analyze the needs of the job and to apply one's knowledge to these needs is more important than specific experience, as the latter may have negative, rather than positive, value. Too much "experience" may be the trouble in the shop of the Excelsior Press Company.

In general, it is well to select a man who has had service in a somewhat similar industry to that for which he is being hired, so that whatever he may have learned will be applicable. I believe that such a man would be more apt to bring success than one who has worked exclusively with presses, as he would not be hampered by traditional ideas in press construction.

D. L. Parkhurst, *Chief, Instrument Division, U. S. Coast and Geodetic Survey.*

Price or Service

When our factory goes into the market for production machinery, we now make it a point to consider service before price. By referring to our past records, I find that where we purchased machinery from the service standpoint, and not on price, it has withstood the heavy productive strain placed upon it and operates with very little maintenance.

A number of years ago, when we were purchasing our machinery on price alone, we ran into a great many difficulties, which caused us to set up what is now known as our "Machine Investigation Department," operating in the following manner. When we desire to secure new machinery, our investigation engineer, through the purchasing department, calls in a number of sales engineers representing the various machine manufacturers. He interviews them, one by one, gathering all possible facts about the machinery in mind, and also visits surrounding factories where similar machines are in operation. After compiling the advantages and disadvantages of each machine, he selects the type that stands out as the best, and places an order on that particular

company through the purchasing department, prices being disregarded entirely, except where two or more machines match up somewhat alike.

Another advantage derived from making visits to the surrounding factories is that it is possible to ascertain whether the machines are able to withstand the rigors of production without being down frequently for repairs. The manner in which this information is secured is by checking the possible machine hours against the actual production hours. By these methods we have found service to be a much more important factor than saving a few dollars on the initial investment, which later are generally lost in production tie-ups and heavy maintenance costs.

—Fred A. Schmidt, *Industrial Engineer.*

Is the Shop the "Goat"?

The majority of shops engaged in repetitive work have undoubtedly experienced the introduction of some type of management system, or efficiency reform. But in these same plants no concern may be felt about waste in the office. However, some firms have discovered that, in departments not engaged directly in manufacturing, improved methods will bring about greater production and lower costs.

In one plant, a good time study man, who knew office work, was sent into several office departments, and applied the same stop-watch time study methods in his investigation as were used in the factory. The results of these studies were expressed in standard time allowances. For many classes of work, a reasonable output hour was thus determined. Before long, the department heads found that they had more help than was necessary to do the work. With output measured in units of time, and a practically constant volume of work going through the office, it was easy to find out how many clerks were needed. To supply an incentive, the factory system of paying a bonus on accomplishment was applied. The results were quite amazing in many instances, and could probably be duplicated in most offices connected with manufacturing plants. —L. F. Swanson.

Discouraging Rush Orders

Everything should be done to discourage so-called rush orders, but everything possible should be done to fulfill a real rush order. The question is, how to distinguish them. This is the task of the representative who interviews the customer and takes the order.

There are some people who have a mania for the word "rush." They use it in every order they give, both verbally and in writing, without the slightest idea as to what it may mean. I have an illustration of the first type.

Some time ago I was called in by a prospective customer to quote a price on some dies he wanted made. The price was satisfactory, but he stressed the point of delivery date. It seemed these dies were badly needed. I naturally took him seriously, and routed his work ahead of everything else, producing delivery on the date specified, at the expense of a great deal of dissension on the part of other members of the organization.

About a week later this customer called me in again. In explaining what he wanted, he found it necessary to take me out into the shop. While passing through I happened to notice the first set of dies lying on the floor with their original rust-proof grease coating still on. They had never been touched. On the second set, he again reiterated the necessity of immediate delivery and named a ridiculously early date. In fact, he intimated that this must be acceded to or he would not place the order with me. I promised to comply with his demand without the slightest intention of doing so.

The date of promised delivery rolled around, and we had just gotten started on the work. Delivery actually was made two weeks afterward, and nothing was said about it by the customer. He just had to have that promise, even though he knew it could not be fulfilled.

Since then I have found many others who operate in the same way. Every order with them is called rush, whether it really is or not. Nine times out of ten the word "rush" does not mean anything. When a customer can show positively that a job is imperatively needed, then everything possible should be done to fill his requirements. It pays to give him the service, even if the order must be placed outside to have it filled on time.

—Frank Browett,
Triangle Tool & Die Company.

Archaic Accounting

When a buyer realizes that an antiquated accounting system is leading a supplier to furnish him with materials or parts at, or below, cost, it is not wise for him to meet the supplier only half way. No firm can live on its losses, and sooner or later the question of a readjustment is sure to come up.

In the case under discussion, where Robinson is buying bushings from the Gordon-Black Corporation at a price lower than that at which he knows they can make them, he will have to inspect future consignments very carefully, because the quality may be cut in order to enable the supplier to break even on the business. Many buyers are far too quick in accepting the lowest prices on work demanding fine limits, and do not consider it their business to find out whether or not the work is being done at, or below, cost. Such buyers may be occasionally very hard hit, and out of pocket in the end, in spite of their shrewdness. It frequently happens that concerns receive prices from men like Black, who do not know what their manufacturing costs are because their accounting system is out-of-date. It is a short-sighted policy to take advantage of a situation of this kind, and the buyer can ill afford to run his business along such lines, even though at first he may appear to be getting away with it.

—L. E. Markey, *England.*

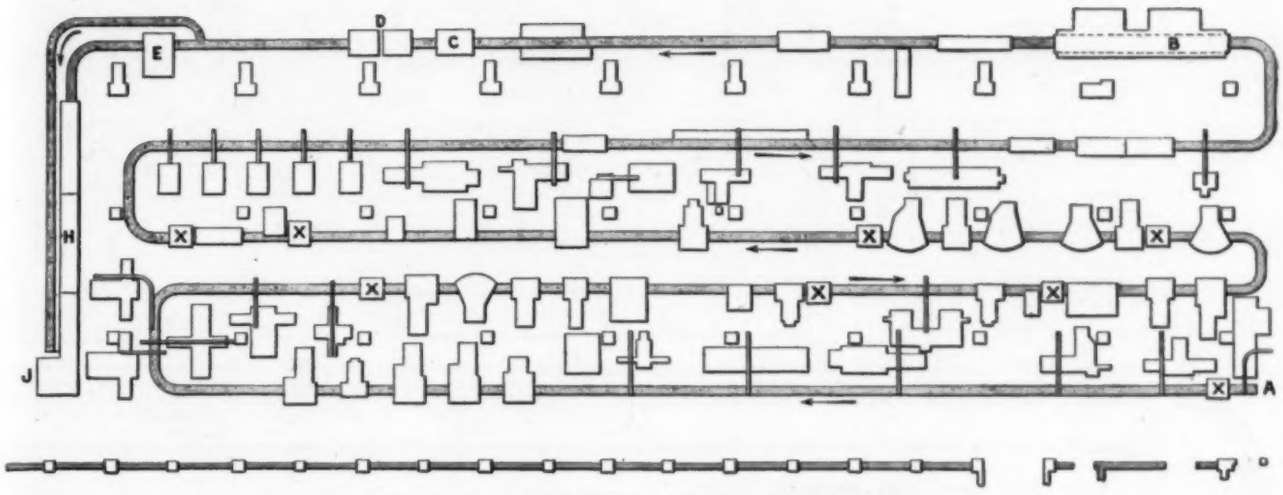


Fig. 1—Layout of cylinder block machining line

Castings enter A and leave at J. The blocks are turned eight times in the "roll-overs" X. After machining they go through the washing machine B, water test C, wash tanks D, spray booth E, and oven H, then by conveyors to the assembly line on second floor where they meet the other parts.

INSTALLING NEW METHODS

IN AN OLD PLANT

IMPROVING quality, reducing costs and increasing output are the aims of every progressive manager. The ability to realize all these aims depends, partly at least, on how well the previous management had been able to keep pace with modern practices along any or all of these lines. It must also be remembered that those previously responsible for results were frequently handicapped by traditions that grow up and around almost any long established business, so that while not detracting in the least from the new accomplishments we can justly temper any criticism of what has gone before.

Taking over an old plant with an excellent reputation and improving the quality, at lower cost and in large volume, is not easy. Accomplishing all these by giving the old personnel the opportunity and arousing their enthusiasm to the point of making many of the improvements themselves, is a tribute to the broadmindedness and tactfulness of the new executives. And when members of the old organization take pride in pointing out the improvements made, both in quality and in methods, their existence is not to be questioned. This, in brief, is an outline of what has been accomplished at the Pierce-Arrow Motor Car Company plant in Buffalo, N. Y., by the Studebaker Corporation.

> Methods that have eliminated unnecessary storage and handling of material by concentrating machining operations, supplying subassemblies where needed, thereby increasing production in reduced space

The changes mentioned are not, as might be expected, the result of unlimited expenditures for new machine equipment. For, much as the executives would like to replace some of the machines in the production line by those of later design and higher productivity, it was deemed desirable to limit expenditures to the point of making the changes pay their own way so far as possible. So while some new machines have been added to the line, nearly all of the improvements are due to a rearrangement of the machines and particularly of the way in which material is handled after its delivery at the plant.

Design of product also plays its part as is so often the case. The former Pierce-Arrow engine was of the old type with the cylinder block and crankcase in separate units, a construction that is retained by only a few builders. This design involved the use of two machining lines, one for the block and the other for the case, anad made the cost of handling the parts considerably higher than at present with the combined unit. At present the combined cylinder block and crankcase come from the Studebaker foundries at South Bend, Ind., where the blocks are rough faced on top and bottom, and rough bored, so as to save the cost of shipping castings with defects that show up during these operations. As a result the loss of work and handling time due to bad castings is almost eliminated. The effect of these sav-

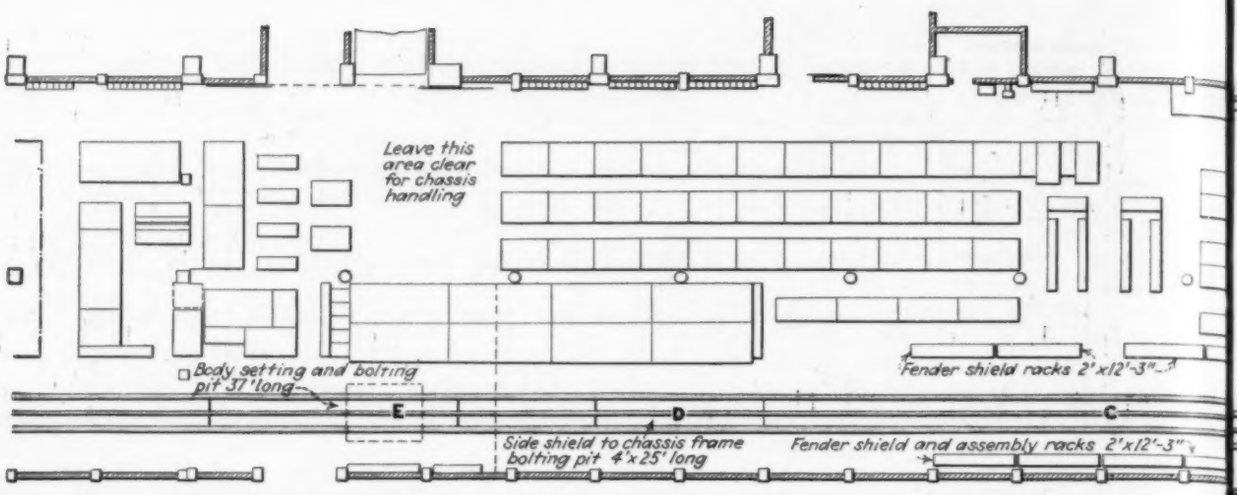

Leave this area clear for chassis handling
Body setting and bolting pit 37' long
Fender shield racks 2'x12'-3"
E
D
C
Side shield to chassis frame bolting pit 4'x25' long
Fender shield and assembly racks 2'x12'-3"

Fig. 3—Final assembly line

Frames reach A with running board brackets in place, engines are mounted at B from storage rack shown. Fender shields are added at C from each side, and side shields go on at D while the body comes down from above, at E. Toe boards, charged batteries and door boards go on . . . . . .

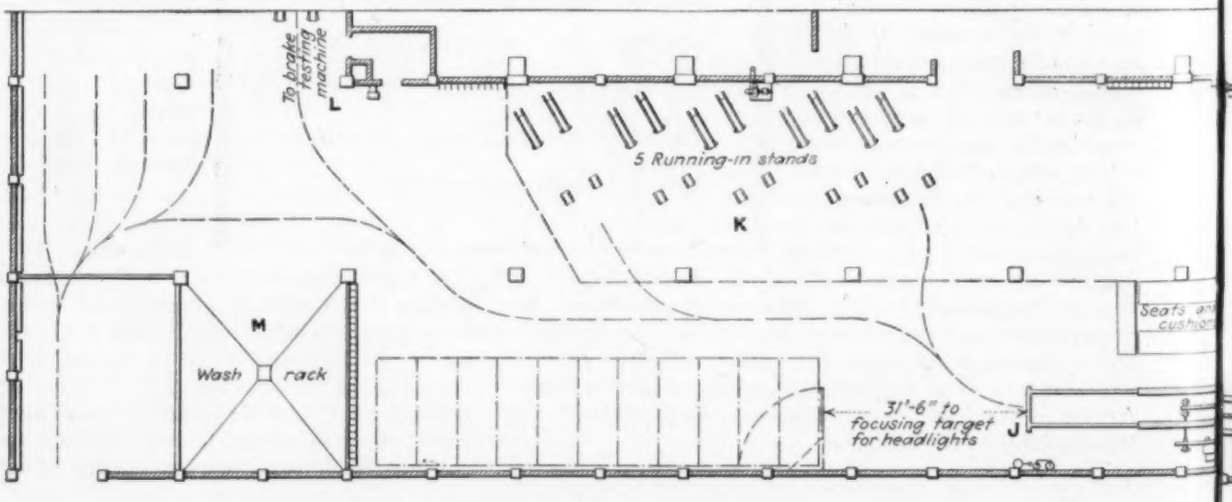
went and from which it was delivered to storage to be drawn on by the assembling departments. More conveyors are used and, in the case of the cylinder block, for example, after it is raised on the conveyor rolls at the beginning of the line, it requires no further lifting as conveyors carry it through the machines, and through both the washer and spraying machines. Both the cylinder block and head are spray painted before assembly.

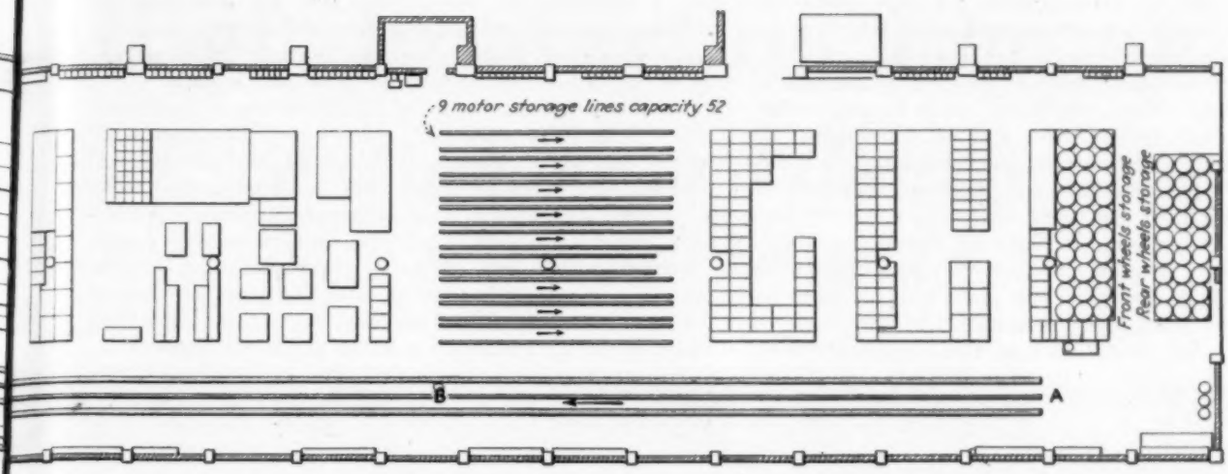
In order to eliminate machine work from the assembly

ings in total costs and on maintaining the production schedule is more important than many realize.

These castings are delivered from the freight car direct to the beginning of the cylinder machining line, the old idea of everything going through a receiving department, to storage and then delivered to the machine department, having given way to the more direct method. Instead of a straight conveyor line as before, the cylinder department is concentrated in one corner of the building, the conveyors doubling back and forth, from one operation to the next, until the block is ready to be conveyed to the engine assembly, on the second floor. The location of the engine department has also been moved to another building and so cut down, still farther, the cost of handling. Incidentally, the amount of floor space required has been very materially reduced.

Movement of material has been cut appreciably, floor and departmental inspection has taken the place of a central inspection department to which every component department and concentrate all operations with the machining line, the valves are ground and the valve springs put in place before the block goes to assembly, on the second floor. This has been found to save time and keep machinery out of the assembling department. It also saves the time of matching valves to their seats, by number or otherwise, and has been found satisfactory in every way. As a concrete result of the new layout, the machining time has been reduced, even though the number of operations has been increased over those required by the two-unit construction. This is because it has been found better to divide some of the operations between two machines instead of combining them as before. As an example of the care used to maintain high quality and uniformity, the final reaming and honing of the cylinder bores is done by a single reamer and hone, so





as to insure all of the bores being as nearly alike as possible.

The layout of the cylinder block department is shown in Fig. 1, which can be studied to advantage. It will be noted how all the machines are compactly grouped, how the conveyor serves them all except those for which hoists are provided to swing the work into the large boring and honing machines, and how the completed block is delivered at the left corner, ready for the assembly department.

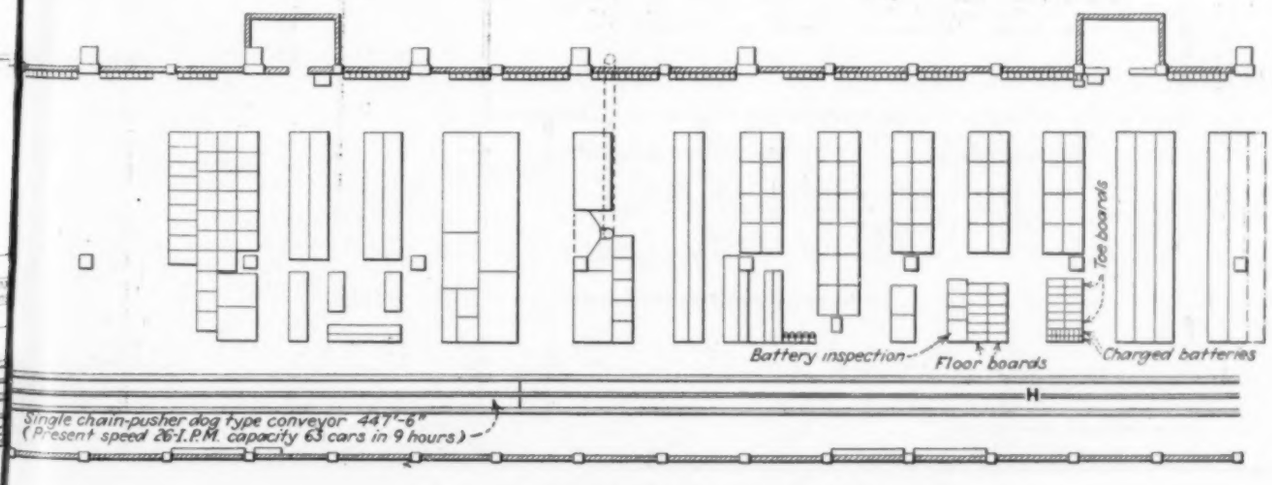
A section of the engine assembly layout is given in Fig. 2 to show how the parts needed are stored right beside the assembly line instead of in an elaborate store room, which would, of necessity, be at a considerable distance. This would also mean not only transportation of the material from stores to the assembly line, but also an auxiliary storage beside the line in addition. By putting the main store where the auxiliary used to be, by controlling the quantity so as to reduce appreciably the amount of inventory and yet avoid delay due to a shortage, a decided saving can be secured.

Here, perhaps, is a good place to speak of part of the system under which the new organization operates. The Layout Division, under a chief, who has been in charge of tool design for many years, now controls tool design, plant layout, and time study. In other words, the three functions that vitally affect production are under one head who becomes responsible for what we might call the means of production. The utilization of the tools and other equipment is in charge of one of the men of the old organization, who is enthusiastic over the improvements that have been made.

Combining the three functions mentioned under one head puts it up to the head of this division to study not only the tools provided, but the way in which they are used and the man who uses them. When the time-study man's reports show that the time required to handle the work in and out of the fixture is a large proportion of the floor to floor time of the piece, it is evident that the fixture can probably be greatly improved by some quick-acting clamps, either operated mechanically or by air.

If the machines are not so arranged as to give the least loss of time between them, here again the same man is responsible and must correct

. . . . . at H, touch up and bolt-tightening follows and the cars come off the line at J. From here they are driven to the running-in stands K, then to the brake test rack L, and out for a road test. When finished they are washed at M.



the error. Such an arrangement, in short, eliminates passing the "buck" between departments, which is the favorite indoor sport in some organizations.

All through the plant the same process of concentrating authority, of eliminating waste space in unnecessary central and auxiliary storage, and of minimizing the amount of handling of material has been going on. Raw material and purchased parts are delivered direct to the place in which they are to be used, after having been inspected as to quality. Perhaps no better example of this can be had than in the final or chassis assembly, which is partially shown in Fig. 3. Here handling has been greatly reduced, more than might be imagined, the frames being delivered direct to the beginning of the chassis assembly line. The step brackets, which are stored in sufficient quantities beside the line, are riveted in place, the axles are bolted on, the frame rolled over, and assembly begins. Complete unit assemblies are made wherever possible, not in another building, but adjoining the line, and stored on convenient racks right beside it, so as to be reached with very little movement or effort. Engines and transmissions, drive or propeller shafts, torque rods, radiators, etc., feed into the line as do steering mechanisms, tires, trunk racks, mats or carpets, and all the minor parts needed on the modern car.

Color combinations so popular today have added to the problem of inventory of parts and of storage conveniently. But experience has shown what colors predominate and it is not as difficult to provide for the variety demanded as might be supposed. Special colors for bumpers, for example, are painted as needed right beside the assembly line, resulting in avoiding accumulating a supply of odd colors and also saving much valuable time over the old method of ordering them done in the paint shop.

A study of the bins and racks beside the assembly line will doubtless show many similar applications in other departments or in business of an entirely different nature. These bins are of the sectional type and can be increased or decreased in size and capacity as may prove necessary. They can be moved to accommodate improved ideas as to layout and can always be located at the most convenient place for the work in hand. The same holds true of the racks in most cases, the combination permitting a flexibility in arrangement that fits well into the present programs of the automotive industries in general. Some racks are portable and are brought, fully loaded, from the department where the parts are made.

Economy has also resulted from the use of operation sheets that show every part number and the amount required per car. This has eliminated the old Bill of Material and gives a check on the quantity needed so as to prevent shortages at most inconvenient times. A running inventory is kept of all parts in bins so as to assure an ample supply and yet avoid running out when most needed. Not only has the new arrangement eliminated unnecessary material in inventory, and unnecessary handling, but it has cut paper work to a marked degree.

All material fabricated in the plant passes through the hands of those responsible for quality and is carefully inspected before going to the assembly divisions. Any rejected parts go from the department where they originate to a central salvage department. Here they are carefully examined by those with authority to decide as to their salvage, whether as to the quality or the cost of salvage. Parts rejected here go direct to scrap with no further inspection, as quality is still the keynote of the whole plant.

Early Installment Selling

By H. M. Darling

WE ARE apt to think of installment selling as a modern development, but it is interesting to note that one of the most successful tool manufacturers adopted this plan many years ago. Back in the eighteen seventies, screw-threading tools were crude and the modern sets of taps and dies, put up as screw plates, were unknown. The old fashioned "jam plates" sold for about $5 per set, mostly going to blacksmith shops.

One of the early builders of threading machinery, F. E. Wells, informs me that in 1873, the first "Lightning" screw plate was put out at his suggestion for $25. Dealers considered this price too high, and said the tools could not be sold in competition with the $5 jam plates. But the manufacturers went out and sold direct to the blacksmiths and repairmen at $5 down and $5 a month.

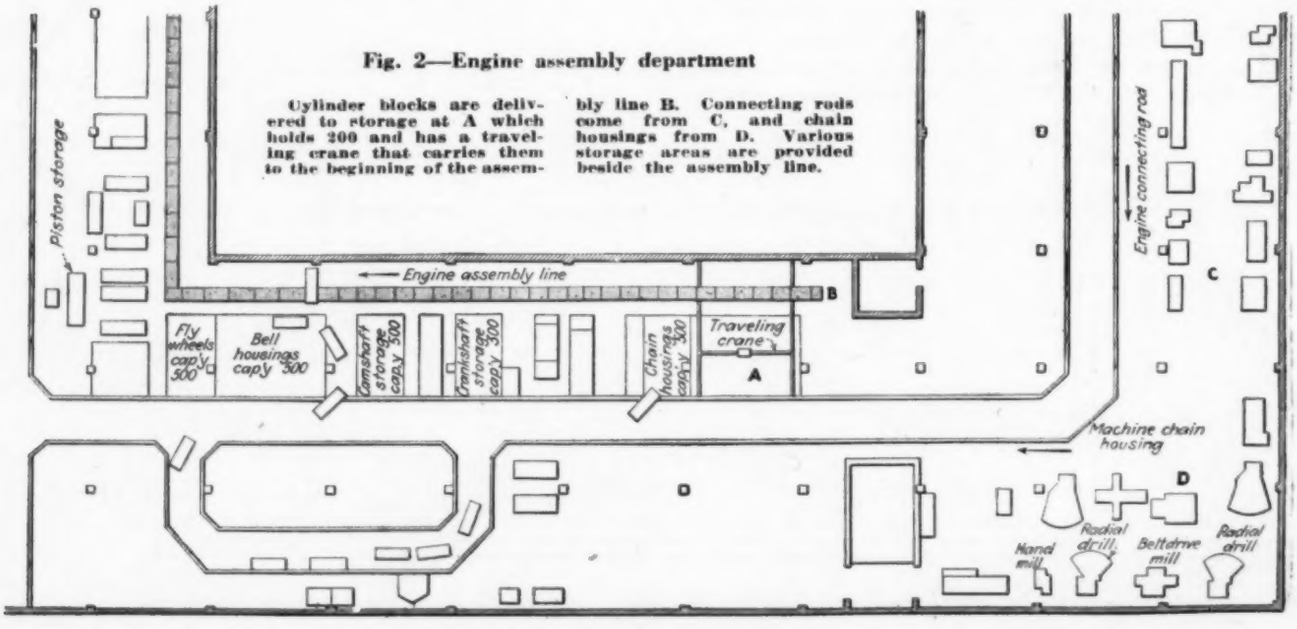


Fig. 2—Engine assembly department

Cylinder blocks are delivered to storage at A which holds 200 and has a traveling crane that carries them to the beginning of the assembly line B. Connecting rods come from C, and chain housings from D. Various storage areas are provided beside the assembly line.

High Production Equipment

For Forming and Heat-Treating the Ford Spring

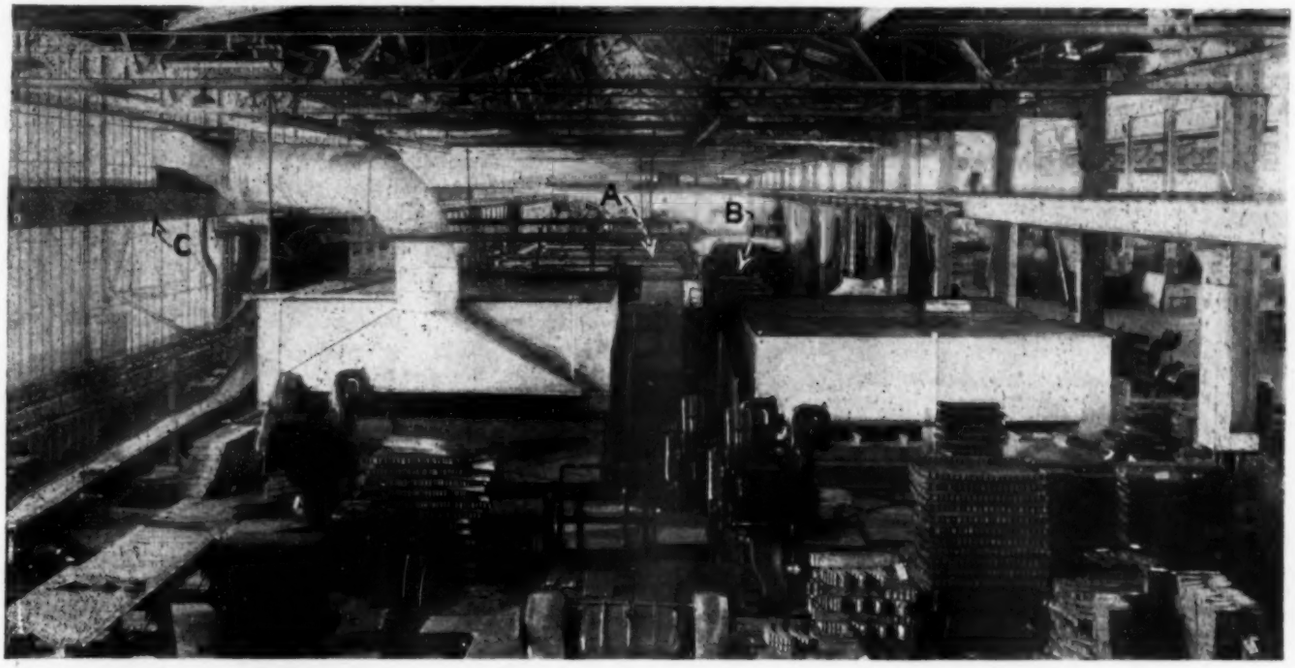


Fig. 1—The equipment for producing 60 tons of springs daily is located in this bay of the shop. The spring leaves advance on the belt conveyor at the left from the blanking presses at the rear. They are fed through the continuous electric furnaces A to the forming and quenching machines B, and thence through the two tempering furnaces. Conveyor C finally removes the completed springs

SPRINGS for the Ford cars, made at the Green Island plant, are of chromium alloy spring steel. The steel comes in rolled bars in five thicknesses and in three widths, $1\frac{3}{4}$, 2, and $2\frac{1}{4}$ in. and is stored on racks in the yard alongside of the spring shop as it is unloaded from the cars. A 15-day stock, or about 50 carloads of steel, is kept in the storage yards. An average of about 60 tons of steel per day is used. The steel is unloaded in the yard from the gondola freight cars by means of a traveling overhead crane at the same time being weighed by a crane scale having a large pointer dial for easy reading.

The steel as required for production is loaded by an electric locomotive crane onto a long trailer truck carrying 6 bundles. The truck is pulled into the press room through a door in the side by the traveling crane within the building. This same crane distributes to the presses.

The presses for cutting up the steel are lined up in groups along one side of the building so that the bar stock can be fed through and the cut-off leaves drop onto a conveyor belt which travels along near the wall. The leaves are chamfered, pierced, and cut off at one stroke of the press, as shown in the punch diagram in Fig. 2. At this plant about 75 different types of leaves are in production at all times. These include 48 front and rear springs for the Model A passenger car and truck, and 50 different leaves for servicing the old Model-T car and truck. One of the groups of presses is shown in Fig. 3 with the trailer of steel being drawn in from the yard. The belt conveyor for blanks is shown slightly raised from the presses, and above is the overhead conveyor for transporting the completed springs to the loading platform outside the building.

> Careful heat-treatment under uniform conditions is the predominating factor in the making of an automobile spring of high quality

The main leaf, or No. 1 leaf, on all springs has an eye on each end for the shackle bolt. For bending these eyes the leaves are taken off the conveyor belt as it passes along the row of furnaces, and fed into a special furnace

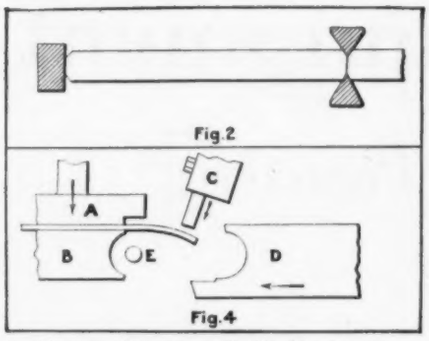


Fig. 2—Diagram of die layout for shearing and piercing the leaves. Fig. 4—Die layout for hot forming the eyes of the main leaf

with a walking type of chain feed. The leaves are heated to a forging temperature on the ends only as they pass through the furnace. At the opposite end of the furnace an operator removes the leaves one at a time and the eyes are bent in a forging machine. A diagram of the slide and rocker arm movements to accomplish the bend is shown in Fig. 4. The vertical side *A* comes down first and holds the leaf firmly against the fixed die *B*. A movement of the punch on the rocker arm *C* bends down the hot end of the leaf so that when the sliding rod *D* moves forward in the direction of the arrow it catches the leaf end and closes it around to the shape of the dies. At the same time a punch *E* moves in from the side to gage the hole.

After the forming operation both eyes are reamed simultaneously in a fixture on a 2-spindle drilling machine, and the leaves are thrown back on the conveyor belt at the side of the room and carried to the furnaces.

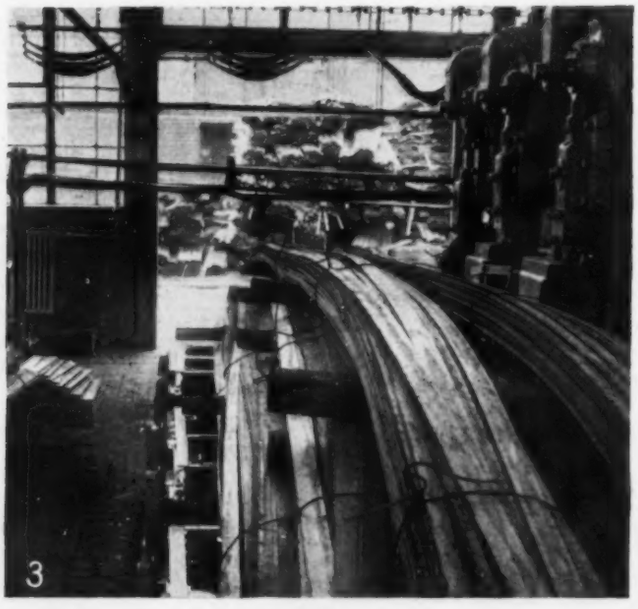
The lineup of electric furnaces for the heating preliminary to bending can be seen in Fig. 1 with two hardening furnaces on the end. All leaves are taken from the conveyor belt and fed through these continuous walking-belt conveyor furnace which advances them two at a time in order to give the operator of the bending machine sufficient time to load and unload the bending machine. A temperature of 1,500 deg. F. is employed for the bending heat. The leaves are in the furnace for a period of 20 minutes in passing through, and the temperature of the furnace is controlled with a variation of only about 5 deg. Potentiometers are used for the control, the temperature being taken at both ends and two separate meters being used, one for the front and one for the back of the furnace. These are illustrated in Fig. 5 at the right of the furnace outlet.

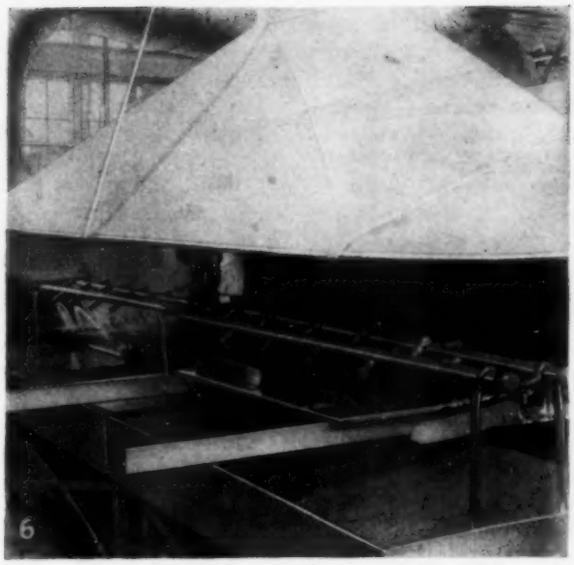
The battery of forming machines is placed at the rear end of the furnaces. The feeding operator on each furnace takes from the belt only such leaves as are being formed by the operator at the rear of his furnace. The latter workman controls the heat and removes the heated leaves for forming. The forming machine, partially shown in Fig. 5, has six dies, the opening and closing of which are controlled by a large cam on the side set in motion by pressure on a treadle. As the dies present themselves intermittently in pairs above the surface of the oil in the machine the operator puts two leaves in one die and removes the two completed leaves from the other die.

As the dies in the machine are revolved the cam action closes the first die, forming the leaf completely before it touches the quenching oil, and then holding it in place in the closed dies during the quenching and cooling period. As the second die revolves out of the oil bath it is opened automatically by the cam. The leaves are formed separately in the dies instead of making the bend in all of the leaves of a spring at one time, since each leaf has a slightly different radius in order to have an initial tension set up in the spring when assembled. The quenching oil used in the forming and hardening machine is a heavy type of mineral oil. It is kept at a nearly uniform temperature by being pumped out continuously through a cooling system. About 40,000 gal. of oil is kept in circulation in the system.

From the forming and quenching machines the leaves are taken in steel baskets to the tempering furnaces.

Fig. 3—Where the spring leaves are cut up, chamfered, and pierced from the bar stock. A trailer of stock being drawn in from the storage yard. Fig. 5—Forming and quenching machine for the spring leaves. The operator loads two springs from the furnace into one die which closes by a cam motion to form the bend and then revolves to immerse the leaf into the quenching oil





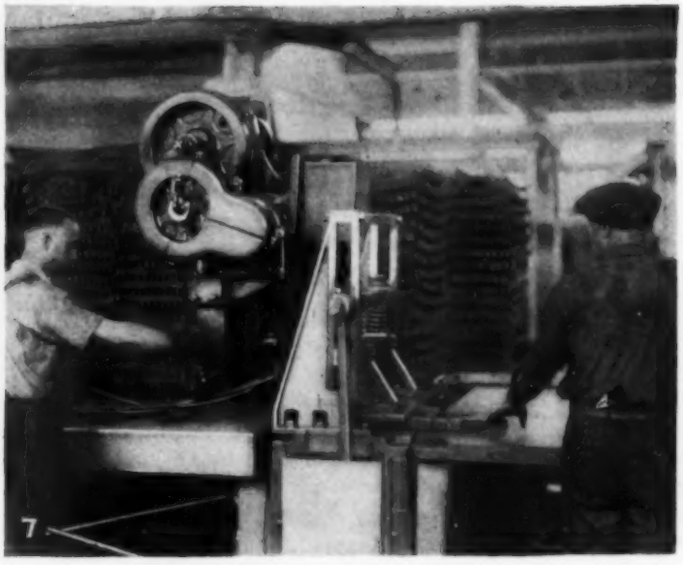


Fig. 6—Quenching the spring leaves as they are delivered from the discharge end of the tempering furnace. They are then piled according to sizes ready for the assemblers. Fig. 7—The leaves are assembled in a fan shape, coated with a graphite oil, and aligned in the continuously acting press here shown. The operator at the right tightens the nut in a bench machine which completes the spring

These furnaces are also electrically heated and controlled. The tempering was previously done in nitrate baths in order to obtain uniformity of heat, but it was found that this uniformity could be obtained in the electric furnace due to the elegance of control characteristics of furnaces of this design, with a big saving, and without the dirt and fumes of the nitrate bath. The springs are fed into the furnace on plates which are conveyed through the furnace on a pusher-type of chain. Leaves remain in the heating zone at 875 deg. F. for 15 minutes, are in the furnace one hour, and are quenched automatically under a spray of water at the end of the furnace conveyor as in Fig. 6. The requirements of this tempering treatment are that the leaf must bend 35 deg. around a ½-in. pin without fracture, and it must show a Brinell hardness of 387 to 444.

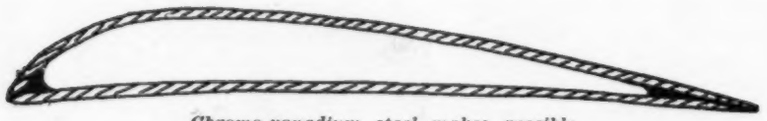
Operators at an iron bench directly behind the tempering furnace assemble the leaves which have been previously piled according to sizes as they were taken off the furnace conveyor. The assembling of the leaves on to the belt is done progressively by three workmen. Because of the different radii of the leaves the spring is assembled in a fan shape to enable the nut to be partly screwed on. The leaves are then painted with a graphite oil and partly aligned into position by hand. The continuously operating press illustrated in Fig. 7 is used to complete the aligning of the leaves. The next operation in the assembly line is the tightening of the nut, which is done on a bench machine.

For the assembly the rear springs where there is a greater radius and consequent greater tension the assembling is not progressive, but is done all at once in a bench fixture, which holds the leaves together while the operator puts in the bolt and tightens up the nut.

The putting on of the clips is done in a bench fixture that holds the leaves together while the clip is hammered on and the clip bolt driven in. At the end of the line the inspector inspects each spring for alignment and general appearance. The completed springs are then hung on hooks on a overhead chain conveyor which passes them through a painting booth where they are given a spray coat of black paint. The conveyor then

Fig. 8—The springs are carried by the chain conveyor to this loading platform ready for shipment in cars or in boats. About 40 per cent of the shipments are made by boat, and are slid down a chute from the platform to the boat

passes through an electrically heated drying oven maintained at a temperature of about 250 deg. F. This overhead conveyor and long drying oven are shown at the left along the window in Fig 1. The overhead conveyor carries the completed springs to the rear of the building and to the loading platform shown in Fig. 8 where they are loaded into freight cars alongside of the platform, or are slid down a chute into boats at the river pier across the tracks. The normal daily production of this spring department is 3,000 front springs, 1,500 rear springs, and 1,000 rear truck springs.



Chrome-vanadium steel makes possible a light welded section in an airplane propeller with greatly increased strength as compared with aluminum alloys

PROGRESS IN MATERIALS

AT THE CHEMICAL SHOW

MACHINERY designers are finding their fourth dimension in materials, a factor that might have been considered a comparatively short time ago as of secondary importance. Instead of adding size and weight to gain greater strength the modern trend is to look to the laboratory to produce a material of greater tensile strength so that the desired dimensions can be adhered to. Likewise, corrosion-resistance can now be met in several different ways, and such physical properties as wear-resistance can be obtained in various metals at will. The materials shown at the Twelfth Exposition of Chemical Industries held in New York from May 6 to 12, were primarily those especially pertaining to the construction of machinery in the chemical processing industries, but many were of vital interest to the general designer as having a much wider practical application in machine construction.

With the call for increased speeds and greater power in airplanes, aluminum alloys, wood, and synthetic resins have not filled the requirements for propellers, with the result that alloy steels of high tensile strengths are being tried. The Vanadium Corporation of America was showing sections of propellers built up by gas welding of chrome-vanadium steel, which when heat-treated have a tensile strength over 100,000 lb. per sq. in. These propellers were developed by the Pittsburgh Screw and Bolt Company. They are welded on the edges and form a stiff, strong section. Only a very slight percentage of vanadium is contained in chrome-vanadium steel, but it has the effect of intensifying the action of the chromium and the manganese in the steel, and also acts as a powerful deoxidizer or "scavenger," making the steel sound and homogeneous.

Chromium plating this turret lathe tool eliminated erosion due to chip abrasion and gave 20 times the ordinary life

An example of the use of a more expensive raw material to produce a lower-priced finished part was shown in the Studebaker 8-cylinder crankshaft exhibited by the Vanadium Corporation. This shaft is made of chrome-vanadium steel, and is die straightened at normalizing temperature. Since with this class of steel quenching is eliminated, the shaft does not require the expensive straightening operation, which cuts down the cost considerably.

A brand of copper-vanadium was exhibited by the same company for use in increasing the tensile strength and refining the grain of copper and bronze alloys. Experimentation has shown progress with chromium and vanadium carbides, and it is not improbable that a complete new category of carbides will take its place within a short time alongside of tungsten carbide for cutting tools, abrasives, and other uses.

Very thin sheet copper in large sheets was exhibited by the Industrial Development Corporation. The largest use of this material in the metal-working industries at the present time is for the making of gaskets, particularly for automotive cylinder heads, but the sizes of the metal obtained by rolling have been generally limited to sheets or rolls up to 8 in. in width. Electrolytic copper can now be obtained in sheets as thin as 0.003 in., and 5 ft. in width. The electrolytic copper is claimed to be very uniform in tensile strength, and not to be affected by grain direction as in the rolled sheet. It is made electrolytically from scrap copper, and as it is almost entirely a chemical and mechanical process with little labor involved it has a price advantage over thin rolled sheets. For automobile radiators and in airplane work it is expected to have a wide field.

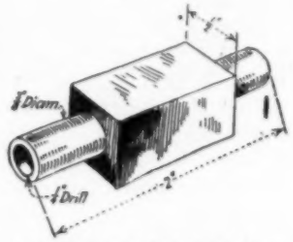
High-strength alloy steels, electrolytic sheet copper, molding compounds, and corrosion-resistant paints are among the newer materials of interest to designers

The International Nickel Company featured at the Show particularly the increasing range of uses of pure nickel. This metal is now going into very large construction such as evaporators. For the machinery of the rayon industry, where caustic solutions are used and where it is required that no copper or iron particles enter the solutions, pure nickel is also being used for machine parts. It is another indication that the first cost of the raw material specified by the machine designer is be-

coming of secondary importance to the final savings in labor or the improvement in product.

Monel metal is an old material finding new uses. Mechanical handling in the pickling room has brought in the use of this metal and other nickel alloys for conveyor chains, parts, and fittings. Exceptionally fine, even castings for such uses as valves, were also known. A new use for nickel and the nickel alloys is flexible tubing for aviation oil and gas lines. The metal is also being used for springs that are exposed to high temperatures.

Hard rubber as a lining for pickling tanks has been adopted as good practice by such companies as Hanson-Van Winkle-Munning, and was featured by the American Hard Rubber Company. It has the stated advantage over other linings that it has 20 per cent elongation, and thus resists breakage or seaming. The tanks are best procured with the lining vulcanized in at the factory, since it is necessary to employ a softer rubber which cures at a lower temperature when lining equipment that is already installed. Pickling baskets with this class of lining and coating were also featured. The Continental Diamond Fibre Company was showing a large line of gears made from Celeron molded resins. Standard practice in these gears now generally calls for metal center bushings held in by an exterior knurling that molds in place, and all of the automotive silent gears except one were made up in this manner. Acid-resistant tubing and fittings were exhibited of molded Bakelite-Dilecto. A hand truck for use in moving materials in the pickling room was shown made up of sheets of the same material with Monel metal fittings.



This copper piece was produced on a 1-in. Acme machine at the rate of 50 pieces per hour with high-speed tools, grinding the tools every 150 pieces. With Carboloy-tipped tools 80 pieces per hour were produced and the tools were ground only every 640 pieces

Tantalum, featured by the Fansteel Products Company, Inc., is a metal that is finding wider use, and has had a recent reduction in cost from about $120 a pound to about $72 a pound. The advent of the A. C. radio tube has opened a big field for it as a rectifier and for grids and plates. Tantalum is uni-directional for electric currents, and is thus a most reliable rectifier. It has also been used recently in machinery construction for small parts that have to withstand the action of sulphuric acid. As a case in point a small reel in a rayon machine formerly made at great cost of glass carefully ground was made more economically of tantalum.

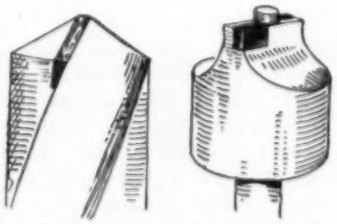
Tantalum is a lustrous white metal resembling platinum, about 50 per cent heavier than lead. It has a tensile strength as high as 130,000 lb. per sq. in., or greater than most alloy steels, so that high strength can be obtained with very thin sections. It is very hard, and has a high melting point, over 5,000 deg. F., but is extremely ductile and can be obtained in wire as fine as 0.002 in. in diameter, and in sheets 0.001 in. in thickness. The metal is remarkably resistant to acids, and is practically non corrodible. It has the property of showing the "interference colors" when heated, as does steel in tempering. But unlike in steel these colors are permanent, since the oxide that causes them does not corrode further like the iron oxides. The metal may be finished in beautiful shades of purple, bronze, or green by electrolytic oxidation. Some further uses of the metal are for instruments and for pen points.

Chromium plating is almost daily adding to its long list of uses in the metal-working industries. United Chromium, Inc., featured it at the Show for both corrosion-resistance and wear resistance. A high-speed tool used on a Jones & Lamson machine, which had persistently shown deep erosion for $\frac{1}{4}$ in. back on the upper surface from the wear of the chip was chromium plated and gave 20 times the previous tool life. It is found that the chromium plating does not save the cutting edge of the tool materially, but it prevents the erosion from chips on the top of the tool which always requires deep grinding to remove.

Another example of the wear-resistance of chromium plating was shown in the tension links on a machine for weaving asbestos brake linings. The links were originally made of high-carbon music wire, but the abrasion of the asbestos yarn in passing over cut into them to a depth of $\frac{1}{16}$ in. in 24 hours so that they had to be replaced in that time. When made of cold-rolled steel and casehardened the life was increased only to 150 hours, but the same steel casehardened and chromium plated showed no cutting at the end of 500 hours.

Chromium-plated files were shown to be giving good service, it being reported that such companies as Brown & Sharpe and the Simonds Saw & Steel Company have adopted their use. A chromium-plated file used on the filing of soft steel gave 250 per cent increased life over that of the unplated file. Incidentally, the Stanley Works and some others have put out tools chromium plated as a rust preventative.

The Kimball Aircraft Corporation has been using chromium-plating for gears, wrist pins, valve lifters, stems, guides, and other parts of its engines. It is claimed to have eliminated noise in the gears and in sliding parts and to have reduced materially the noises that are so objectionable in the cockpit. Other uses shown as recently adopted for chromium plating are for knurling tools, and for drawing dies. In copper-drawing dies the production without serious abrasion of the die was increased from 10,000 to 60,000 feet drawn. This opens a possibility for such dies as those employed for cartridge shells where the life of the ordinary die is short. Tests are being made on the plating of the inside of deep holes, and some success has been attained on the chromium plating of the inside of an airplane engine cylinder. There are times when the designer is looking for fine mesh wire cloth for screens and filters, and has been limited to 325 mesh as the smallest available size. The Newark Wire Cloth Company showed wire cloth made regularly in 400 mesh. This screen is made of phosphor-bronze wire 0.002 in. in diameter, and there are 160,000 openings to the square inch, or actually a million square holes in a piece 2½ square inches. This wire



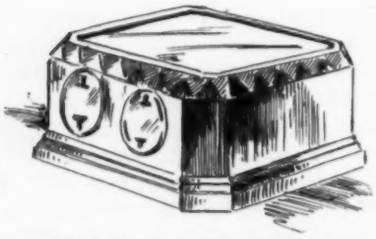
Carboloy-tipped twist drills are now in production and are giving results. Counterbores faced in this manner are also showing savings in grinding time as well as permitting increased speeds

cloth has a wonderful advantage over the old-time fabric filtering mediums for oils and other liquids as it will stand up for long periods and does not have to be replaced frequently.

The Carboloy Company, Inc., exhibited the latest developments in the uses of tungsten-carbide cutting tools. Twist drills are being very successfully tipped with this material, and the Cleveland Twist Drill Company is now in production on Carboloy-tipped drills. It is also being applied to counterbores with excellent results. Another field that is opening up with wide possibilities for this material is that of wire drawing and deep shell drawing, especially for drawing non-ferrous metals.

Possibilities in production turning in non-ferrous metals were illustrated by the case of a bronze bushing about 1 in. long, 1½ in. in diameter, and having a 1-in. hole. It was made on a No. 4 B. & S. screw machine, and with high-speed tools the production was 15 per hour. The tool had to be ground every 15 pieces. With Carboloy tools the production was 25 bushings completed per hour, and the tool averaged 215 pieces per grind. The great point featured was that high first cost is insignificant in the final comparison with production results and saving in regrinding and set-up times.

Elkonite, a tungsten-copper diffused metal, exhibited by the Elkon, Inc., has been showing tremendous endurance as a metal for the electrodes in electric-welding machines. Not only is the life much longer than with the old copper electrode, but the welding heat can be increased by the use of greater amperage for rapid spot welding. Ford and other automotive companies have generally adopted it. This is one more example of the use of higher-priced material to obtain cheaper final results.



Molded resins such as Bakelite, Durez, Karolith, and Textolite, are being widely used to replace metal for parts where deep drawing or costly intricate cast pieces were formerly required

Krupp Nirosta steels, containing a high percentage of chromium, were featured as a new development in stainless steels having great ductility and deep-drawing properties. Parts made from this steel were exhibited by the Central Alloy Steel Corporation, the Ludlum Steel Company, and the Babcock & Wilcox Tube Company. This steel is now being adopted in the automotive industry for hub caps, radiator caps and other parts. A bumper was shown made of the steel, although its chief feature is as a deep-drawing material. It is now made in fine wire down to 0.0001 in. in diameter, and in sheet as thin as 0.003 in. Nirosta steel has a more silvery luster than chromium, and is free from the bluish tinge that some find objectionable in chromium plate.

The deep-drawing qualities of this stainless steel recalls the free-turning stainless steel, especially adapted for screw machine turned parts, that was recently offered by the Carpenter Steel Company. These two products now place the non-corrosion chromium steels in a place where the designer can call for them on parts that require considerable machining. The Carpenter Steel Company is now offering a stainless steel that is also scale-resistant at high temperatures.

Victor Hybinette, well known in the field of heat-resistant alloys for heat-treating boxes and furnace parts, is now bringing out new developments in aluminum alloys. Of these, the "non-corrodible" and "anti-fatigue" alloys contain nickel and chromium and are capable of improvement by heat-treatment and aging. Other of these aluminum alloys are "plastic," and can be improved by working the metal.

Baker & Company, Inc., has recently been working with the Bureau of Standards for the change of standards relating to platinum-rhodium thermocouples. This company has found that the distillation of the metals in the couple at temperatures above 1,300 deg. C. destroys the accuracy of the thermo-element and it ceases to record the heat of the furnace with exactness. The most commonly used wire for this purpose is made of 90 per cent platinum and 10 per cent rhodium in 0.020 in. diameter. The Baker Company is now limiting its guarantee of accuracy to 1,200 deg. C., and pointing out that this accuracy is destroyed by the customary annealing at 1,500 deg. C. The same company is now offering a newly developed couple for thermostatic control for lower temperatures made up of Invar against brass, and also one of stainless steel against brass. These are used for temperature controls at comparatively low temperatures and are made up to suit conditions.

A line of castings of Mayari iron, which is a natural nickel-chromium iron, was shown by the Bethlehem Steel Company. These include fine casting work, such as pistons and cylinders, of very even grain and high strength. Such acid-resistant irons as Duriron, shown by The Duriron Company, are finding increased use in castings for pumps and machinery that might come in contact with corrosive conditions. Recent improvements in machining methods on these high-silicon irons have opened new fields of use.

A recent development is flanged pipe, fittings, and sockets made of glass for use where acids or chemicals are used in the equipment, or where it is desired to have the contents visible. The industrial glass shown by the Corning Glass Works under the name Pyrex is a low-expansion product capable of withstanding considerable heat and shock. It is molded to many shapes.

Electric welded construction for high pressure and high temperature work was featured by the A. O. Smith Corporation. This company is now using 100,000 tons of steel plate a month in welded products. It featured welds on plate as thick as 3½ in. that show strength equal to the original metal.

The economy in labor saving on all-welded parts is shown by the use of only 120 workmen to produce 10,000 complete automobile frames a day.

This spring bucket head in a rayon machine was formerly made of acid-resistant metal, but was replaced by molded Durez requiring no machining

Lead lining for sheet-steel chromium-plating tanks was featured by the Gross Lead Burning and Coating Corporation. This work is done by the lead-burning process and permits the tanks to be made up complete with the fume ducts built in to prevent the dangerous chromic-acid fumes from entering the plating room. The same coating process is also advocated for coating machine parts that are apt to come into contact with

acids, alkalis, or chemical fumes. It is being used successfully for coating fans, blowers, and pumps. The coating is fused to the base metal and no tinning is required. It is claimed not to peel, crack or blister when in service.

Acid-resistant paints are now offered in all standard colors, and as they are particularly resistant to oils, gasoline, and soda water used in the machine shop, they are being offered for the painting of all classes of machinery. The Quigley Furnace Specialties Company, Inc., exhibited a line of acid-resistant paints suitable for this purpose and for painting of equipment in pickling and plating rooms. It can be sprayed or brushed, and dries quickly so that the parts painted can be moved in 20 to 30 minutes. It dries with a luster comparable with the lacquers and is as readily cleaned. Another "rust-proof" paint, Rubalt, shown by Alfred Hague & Company, Inc., is in the same category and is also offered in colors that keep their luster under corrosive and oily conditions.

A most remarkable recent development as applied to the metal-working industries is the increasing use of molded synthetic resins to replace metals. The Bakelite Corporation was one of several companies that displayed a wide variety of parts made from these resins. The molding compounds are supplied to the molders in powder, in "pills," or in sheet, tube, and rod. Special hot-molding presses have been designed which make possible rapid production of parts in multiple molds. Very thin sections can be molded, and when the compounds have cured by heat and pressure in the dies the parts are hard, strong, and resistant to moisture and chemicals. For such parts as clock cases, which formerly required difficult drawing and embossing operations in metal, these molding compounds are finding a wide application. They are also being used for gears, handles, switch and meter boxes, and numerous small parts. When molded with wood, paper, or cloth fabric fillers they have very considerable strength, and as they are unaffected by oils they are readily applicable to many mechanical parts. The resins are now made from many different chemicals, and sold under a variety of trade names, each type of compound having physical properties adapting it to particular uses.

Costly Selling Tactics

By W. F. Sandmann

THE general manager surveyed the heap of catalogs, circular matter and correspondence that was stacked on the desk before him. Then he addressed the superintendent and purchasing agent who were sitting opposite.

"You two complain about the high cost of machinery. Here is a good example of what helps to keep the cost up. We have just placed our orders for three machines that will cost us a total of not over six thousand dollars. All this literature and correspondence pertains to those three purchases, and we can well liken it to a barrage that preceded the charge of the troops." From the drawer of his desk he produced a neat packet of cards held together with a rubber band. "And these are the identification cards of the shock troops—seventeen good salesmen—with their objectives a slice of a mere six thousand dollars worth of business."

"It has interested me to compile a few figures—just to see what part of the six thousand dollars went toward paying for this assault. These seventeen men came from twenty-five to two hundred and twenty-five miles to call on us. I have estimated their total round trip mileage at better than thirty-five hundred. Several used sleeping cars both ways, others spent at least a night at a hotel. I have figured their mileage, traveling expenses such as meals, hotels, etc., and from the total have subtracted quite a sum that should apply toward any other calls they made while in our city, and yet I still have a total of over six hundred dollars remaining that applies to ourselves. Over ten per cent of the cost of our purchases went to pay for sending this group of men here to chat with us."

"How else could we buy machinery?" asked the purchasing agent. "We had to know what was offered before we could place our orders. And we had to know the market price on similar machinery."

"For example," smiled the manager, "a turret lathe was one of the items we had listed. We have two makes of turret lathes in our shop at present. Trade magazines carry the ads of several more. Instead of writing all these companies for quotations, why wouldn't it have been as well to have asked them for a catalog for our file as we had noted their ads. Also tell them that should we be in the market at any time for any of their equipment we will write for quotations. There are several of us around here drawing our salaries because we have demonstrated that we have good, common sense and we certainly should be able to sit down at a table with the catalogs of these various manufacturers before us and pick out the one that interests us the most—or at least narrow the field down to two before calling for quotations. In this particular instances we had eliminated ninety per cent of the bidders before their representatives arrived—and we saw no reason for altering our opinions after listening to them.

"As to market prices any machine tool builder of standing has but the one price to offer, and that goes for everybody. We don't buy on price alone—we buy what appears to be what we need and want. Don't you believe machinery builders appreciate such policies?"

"Some of them may, perhaps," spoke up the superintendent, "but from my experience in the last few days with this flock of salesmen it is my opinion that every machine manufacturer is so afraid some competitor will get an order without a struggle that he would almost send his whole sales and executive force out as a preventive. They have their selling costs amply covered by their prices, so I guess we only got what we were paying for."

The general manager proceeded to fill his waste basket with the pile of literature on the desk before him. "Well," he remarked, "some day the machine tool people will get wise to themselves—and just think how lonesome it will be for us when we are in the market for new equipment."

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Ed and Al Agree on Obsolescence

. . . They're Against It

THE men had gone home but two of the foremen were still in the shop. They were in Ed's department and they were looking, somewhat unfavorably, at a row of machines that had unquestionably seen their best days.

Al broke a silence. "So Williams wants to get rid of those relics does he?"

"Yes," replied Ed. "He believes we can get out the work a whole lot cheaper if we replace 'em with the new motor-driven machines that were announced in the A. M. last fall. Wants me to get together a lot of figures on output, and upkeep expense."

"Well, you don't object to doing that, do you?"

"Not exactly. But what's the use? I'm ready to agree that new machines will do a better job than those relics."

"Oh, you are?" Al looked mildly surprised. "I thought you were so fond of those machines that they could only be taken out of your department over your dead body."

Ed started to protest, but Al stopped him hastily.

"I was only kidding you, Ed. But you know you have bragged a lot about that old line-up. Now, I don't pretend to know what was in Williams' mind but he did that to me once. I couldn't see any point in digging up all those figures, but I finally did it. They were eye-openers to me, Ed. I was pretty sure I could save maybe thirty per cent if I got the new equipment we had been considering but the figures showed we'd save seventy-five per cent."

"Well, did you?"

"Did we? After we got things running we saved eighty per cent, and even better. Why, that equipment paid for itself so fast that it seemed a crime to pay the builders what we did for it. After that object lesson I'm willing to do a little figuring if Williams thinks it's worth while."

"All right, all right," said his friend. "I'll do it, but don't get the idea that I'm against new equipment in my department. I'm for it, a thousand per cent. And so is every other foreman that knows anything about his job."

"Hurray!" jubilated Al. "For once we agree absolutely. Let's go out and celebrate. Here comes Williams, let's take him along."

"Fine," agreed Ed. "Let's go."

There being no argument over the soundness of installing new equipment to replace obsolete units, the only point at issue is whether it pays to figure out in advance what the savings will be, or just take it for granted that the principle is of universal application, and spend the money.

Who is right on this point, Al or Ed?

All foremen are urged to discuss these questions vital to their work; of course the

DISCUSSION OF EARLIER TOPICS

Al Orders an Emergency Pump

THERE can be no doubt but that Al is in the right. The cost of the pump, even if a very good one, could only be a small fraction of six thousand dollars, and breakage of delivery promises often has an exceedingly bad effect on the customer when further orders are in contemplation.

Williams left an assistant in charge. Both Al and his man were convinced of the necessity of maintaining output, and it seems that Brown was in no position to "kick" unless he was able to say that the maker could and would have put the whole matter right just as quickly as Al got the new pump.

Under such circumstances Williams was right in commending Al for having the backbone to get it going again even at the risk of being "called down" later. That action showed real initiative, a commodity scarcer than one could desire.

—C. NORMAN FLETCHER, *Cheshire, England.*

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Helping the Tool Designer

BEING a tool designer, and having had considerable shop experience, I feel that I should invite suggestions from the foremen and that they should be willing to respond. The foremen should also feel free to make unsolicited suggestions. Although a tool designer may have shop experience, he may not have the best ideas in his tools until he picks the best points from his own ideas and the suggestions he receives.

I have always found it best, on complicated tools, and very often the simple tools, to make sketches or layouts and ask all interested parties to come into the office and have a discussion on the problem. An agreement is then reached on what changes are to be made and it also gives all parties an insight into the working of the tool.

—RALPH N. STRYKER, *Tool Designer.*

*

Helping the Tool Designer

NO QUESTION exists, in my opinion, as to the importance of consultation with the foremen regarding tool design, to the extent of a round-table conference between all interested parties before a single line is drawn on paper. This procedure is not a reflection upon the competence of the tool designer, nor is it an effort to "pass the buck." As a matter of fact, it is the method followed in all up-to-date plants and applies equally, whether the organization is large or small.

Obviously, the man who uses the fixture or tool has the right to comment upon its design, and in my experience, he is usually not only willing but competent. The designer, on the other hand, has, or should have, ideas which are equally good, and the result as a rule is satisfactory to all parties.

There should be no prejudice on either side, or lack of co-operation, as at the last analysis it is results which count with the management, and these results, if satisfactory, reflect equally well on both the shop and the drafting room.

—STANLEY W. MILLS,
Pierce Arrow Motor Car Company.

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Shall a Man Sit Down to Work?

THE day of the standing desk for the bookkeeper is over and our business executives sit down at their labors in order to avoid fatigue and to allow their minds to concentrate on the business before them and not on any bodily discomfort.

When a workman in the shop can so arrange his work or machine that he can sit down, without loss of production, he too can save himself physical fatigue and be in a better condition to perform his duties, and be a happier and more contented employee.

Sitting down while at work does not necessarily mean that it is to be a half asleep posture. A man can be alert to his work sitting as well as standing.

Sitting down, with mind and eyes on the job, in a shop where comfort of employees is given consideration, is surely better than a lazy, half leaning position where sitting down is forbidden.

The foreman should be the judge as to whether a job calls for sitting or standing, and should act accordingly.

—S. E. HAMILTON, *Foreman.*
The Gates Rubber Company.

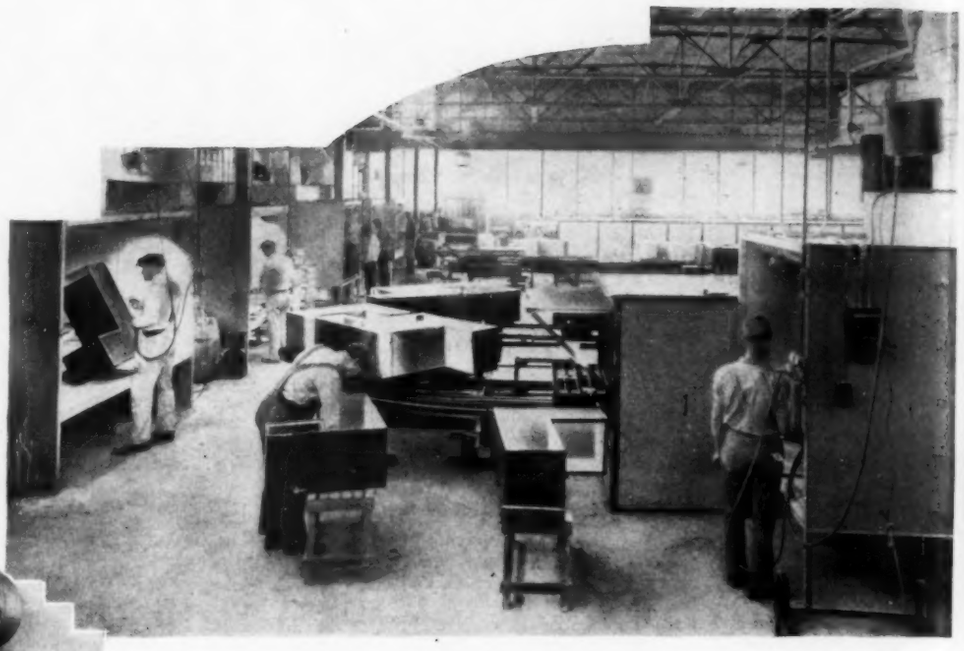
THE · NEXT · TOPIC

Oil Cups Or Force Feed

Is Ed's argument for the oil cups sound? Or are Al's reasons for preferring pressure-feed systems more logical? And who should be responsible for either system?

discussion is not limited to foremen. Letters accepted and published will be paid for

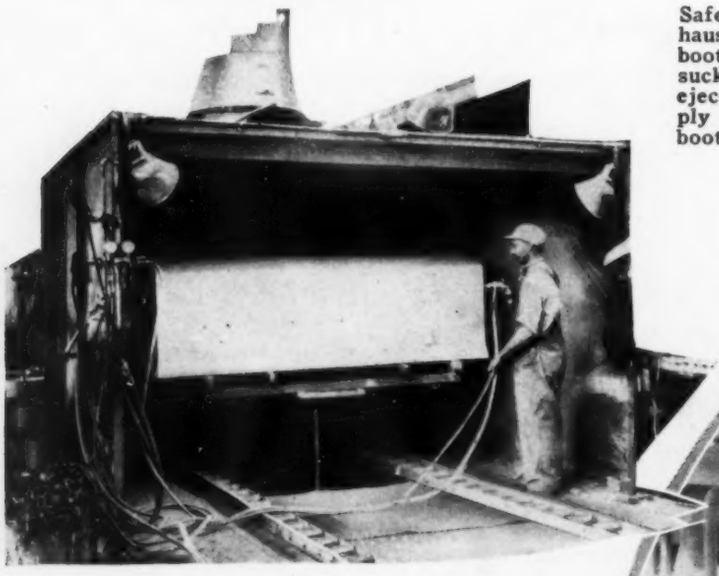
A group of finishing booths shown grouped around two mechanically-fed enameling ovens. The layout is particularly to be commended because of the freedom of space and lack of congestion. Although the room is well lighted, separate vapor-proof reflectors are provided at the front of each booth. Enamel is supplied from an overhead container suspended from a light block and tackle arrangement. Air comes from a central source but at each booth passes through a transformer where oil, water and dirt are removed and where the pressure can be regulated.



Modern Equipment Puts th
on Metal Articles . .

An explosion-proof exhaust unit is featured in this model spraying booth installation. The booth itself is made from steel panels welded to angle iron frames, and the turntable is also all metal. Besides an air cleaner, this unit has an electric heater for the air supply for use with varnish, which is supplied from a 9-gal. pressure feed tank.

Safety from explosion of inflammatory vapors in the exhauster system is featured in this series of paint spray booths for automobile body work. The vapor-laden air is sucked out of the booth by means of the aspirator or ejector principle. Fans supplying the secondary air supply can be seen along the outside walls of the spray booths.

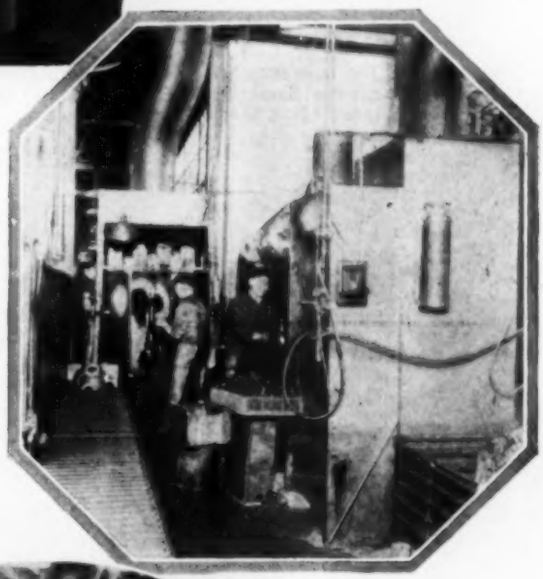


In this spraying installation each vault is pushed into the booth on the roller conveyor shown and is lifted clear by the air-lift turntable. The aluminum paint is supplied from a pressure feed tank.

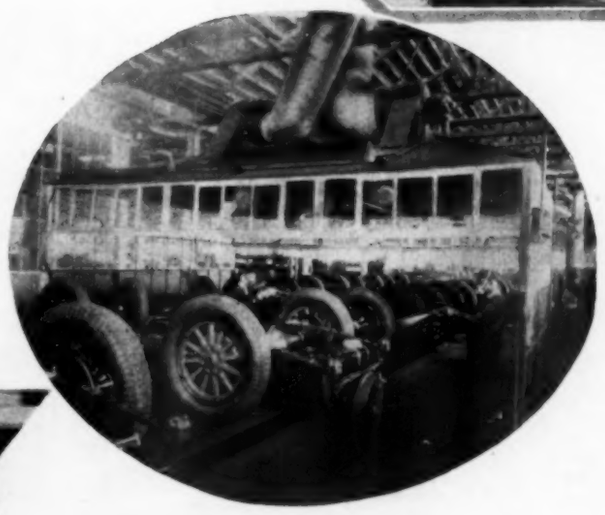
An automobile wheel is an excellent example of a case where air-spraying methods are much faster and cheaper than hand brush methods. By mounting the wheel on a mandrel inclined about 30 deg. from the horizontal the wheel can be spun readily.

Spraying rear-axle housing halves in an automotive parts plant. The gravity roller conveyor brings the parts to the booth where one part at a time is suspended from an I-bolt by a wire. As soon as the axle housing is completely covered it is transferred to the baking oven conveyor immediately adjacent.

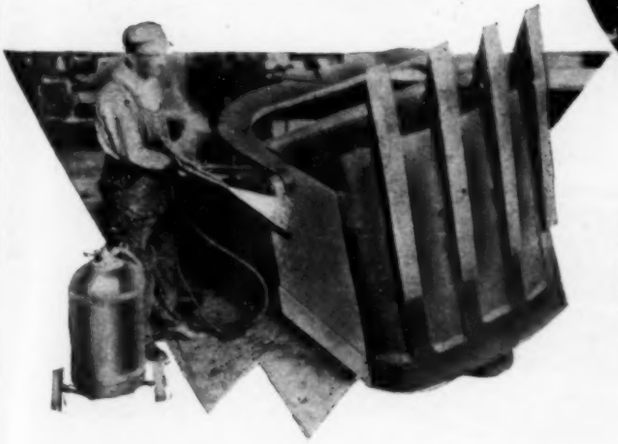
the Finishing Touches ... *Both Large and Small*



Photographs by courtesy of the DeVilbiss Company, the Newcomb-Davis Company, and the Paasche Airbrush Company.



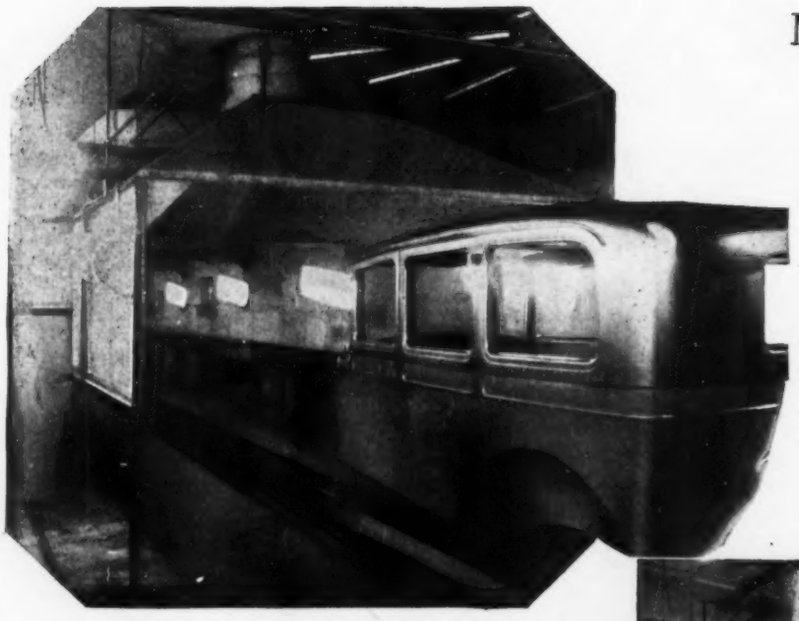
Circumstances often dictate the position of the finishing booth. In the unusual application pictured automobile chasses, inverted, are being sprayed as they pass down the assembly conveyor line. Although two exhausters are used, on account of the inefficient ventilation caused by the large air space, the operators wear respirators.



Even large, rough machinery, such as the excavator bucket shown, is being sprayed instead of hand painted, and at about half the cost. With the improved method the paint gets in every crevice, and the final result is a better looking job. A portable pressure feed tank is used.

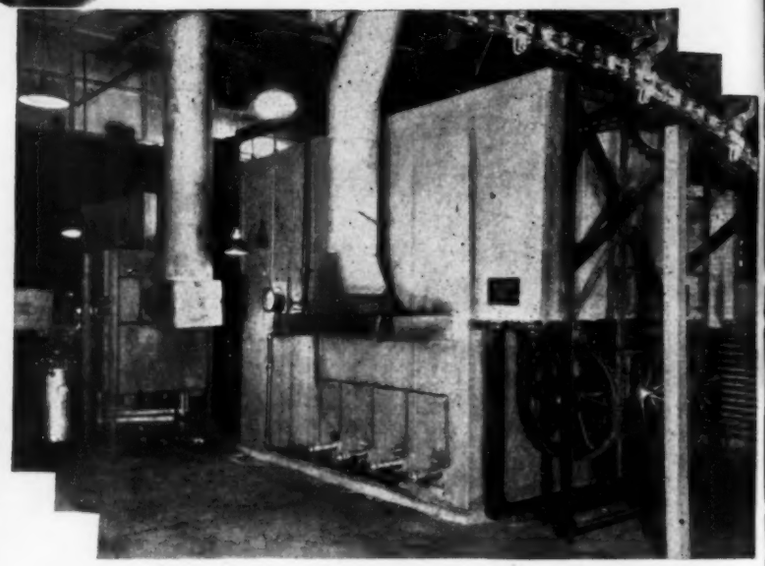
Modern Equipment Puts the

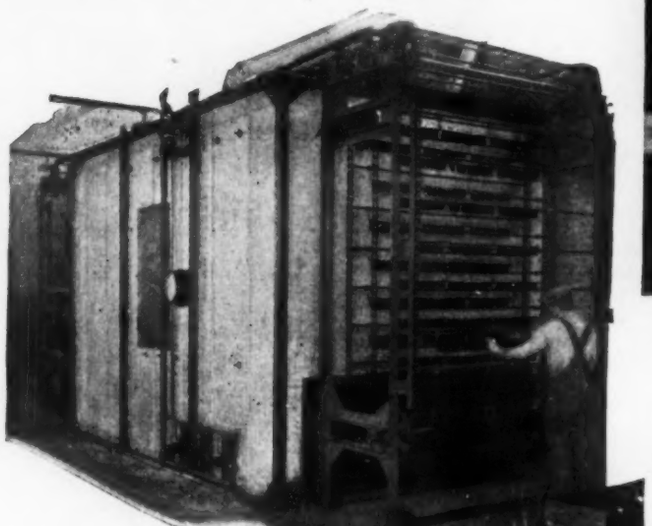
on Metal Articles



Automobile body entering a tunnel-type spray booth ventilated by the aspirator principle. Note that 3 to 4 ft. of clear space is left between the floor and the bottom of the tunnel side walls. Illumination is by mercury-vapor lamps spaced at regular intervals along the walls. Portable pressure feed tanks are used, and suitable hooks are provided on the walls to hold the spraying equipment.

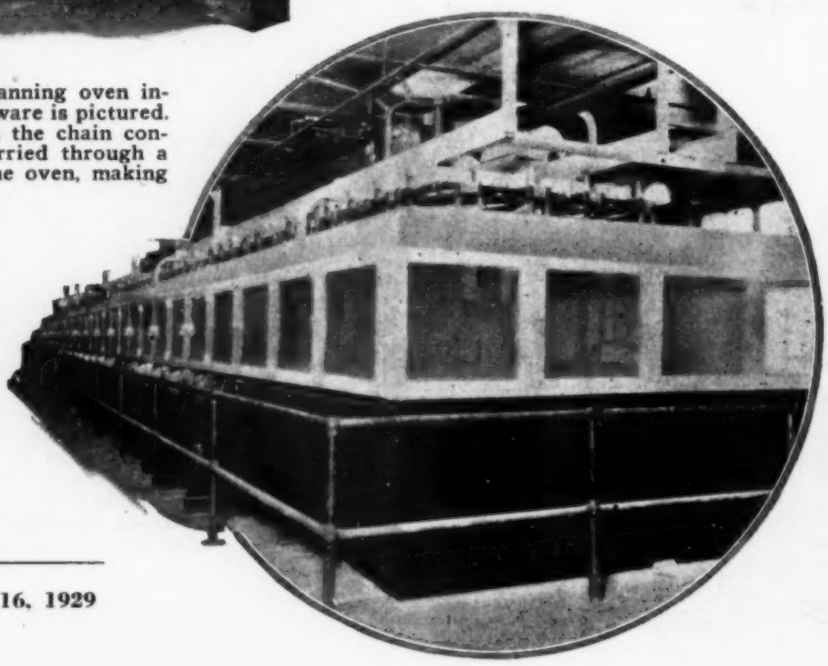
Photographs by courtesy of the Newcomb-David Company, Inc., the Swartwout Company, and the Gehnrich Indirect Heat Oven Company, Inc.





Paint drying is hastened by passing the articles through hot air ovens. In the particular installation shown gas fuel is used and the parts are carried through continuously on conveyor chains. A burner outside the oven proper forces warm air through the entrance port, sealed by gravity.

A completely mechanical japanning oven installation for automobile hardware is pictured. Parts are loaded on racks on the chain conveyor at the far end, are carried through a dip tank, and then through the oven, making several vertical passes. Two vertical passes are made also in the outside air to cool the parts before they are unloaded by hand as shown. Thermostatic control is used, and the conveyor speed is adjustable from a ½- to 2-hour bake.



Complete inclosure of the plating tanks is featured in this full - automatic zinc plating installation. The action of the plating conveyor, which is the heart of this machine, may be observed through the row of wired glass windows in the side walls.

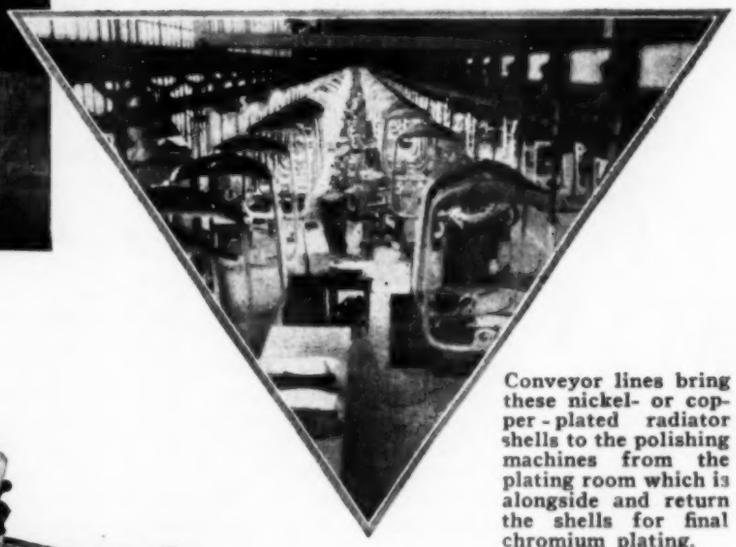
Finishing Touches

. . . *Both Large and Small*

Photographs by courtesy of the Western Electric Company, the Contract Plating Company, the Chrysler Corporation, and Hanson-Van Winkle-Munning Company.

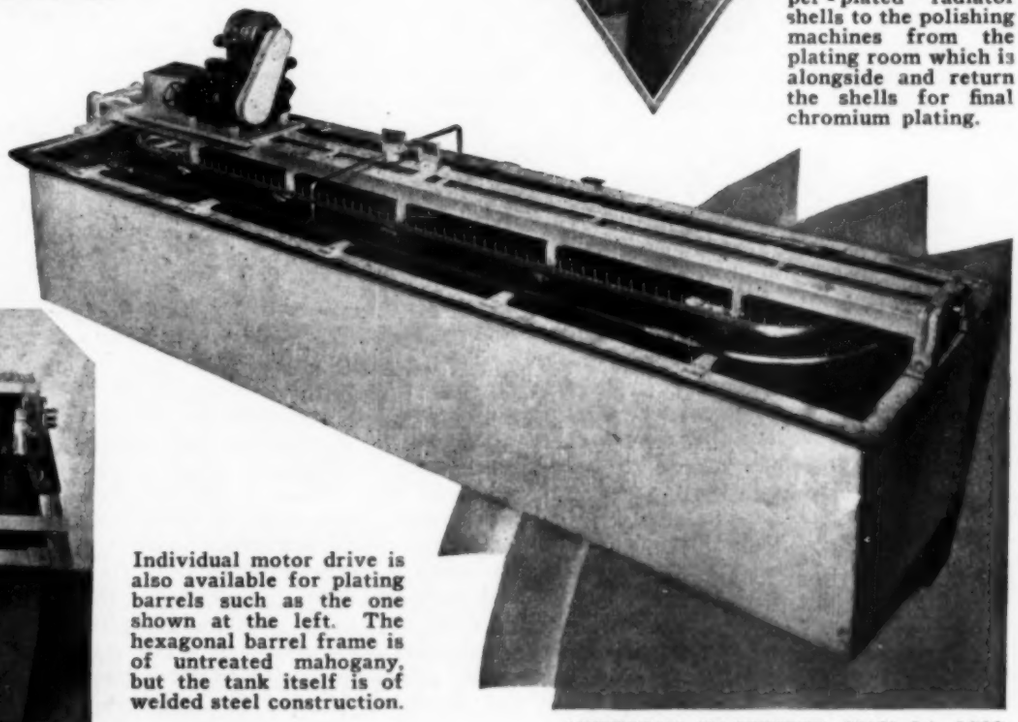
Another view of the inclosed automatic zinc plating machine showing the loading station. Racks carrying the parts to be plated are conveyed by an overhead trolley with transfer mechanisms to lift them out of one tank and lower them into another.

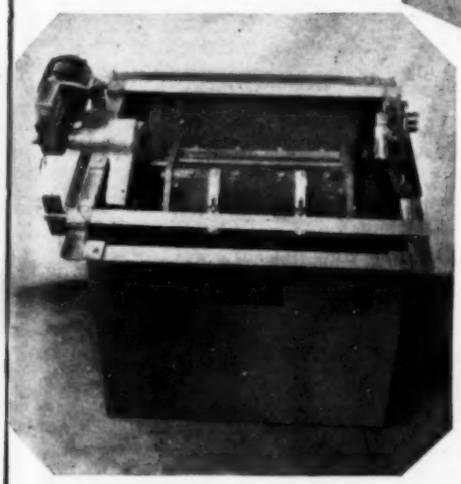
Part of an installation of 50 tumbling barrels made of either wood or brass. They are located in this particular installation, which is in a job plating shop, alongside of the plating department. In the horizontal barrels in the right foreground delicate parts, such as those having screw threads, can be polished, without injury, by ball rolling.



Conveyor lines bring these nickel- or copper-plated radiator shells to the polishing machines from the plating room which is alongside and return the shells for final chromium plating.

In this semi-automatic plating unit, in which the racks carrying the work are conveyed around the tank by the chain and pins, a motor variable-speed drive is used to regulate the speed of travel and hence the length of the cycle.

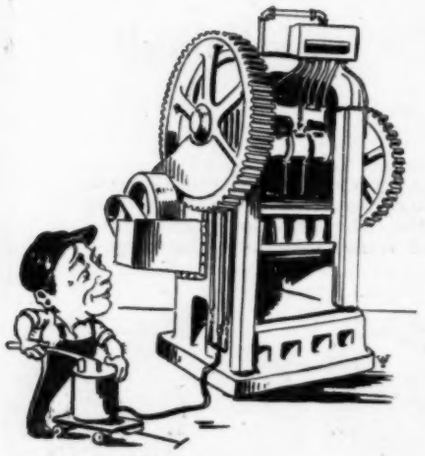




Individual motor drive is also available for plating barrels such as the one shown at the left. The hexagonal barrel frame is of untreated mahogany, but the tank itself is of welded steel construction.

LUBRICATION

Its Importance and Improvement



ADEQUATE LUBRICATION is the designer's worry today. It is no longer the curse of the man in the shop alone. Keen buyers of equipment of all kinds are demanding that it be provided with lubricating devices that work, and the lack of them may lose the sale. The whole subject will be opened up in the series of articles of which this one is the introduction

* * * *

MODERNIZATION of plant equipment is the order of the day. New machinery, however, no matter how high its efficiency when in operation, is not an asset if it is subject to breakdowns or stoppages. In order to earn maximum dividends it must be capable of running continuously during the hours the plant is in operation. Continuous production, however, frequently depends on a factor that has received too little attention in the past—positive and regular lubrication of all bearing surfaces. Unless ample provisions are made for thorough lubrication, new machine equipment may easily prove a disappointment.

Lubrication is viewed from many angles and may be defined in various ways. As generally considered it is the introduction of some sort of a lubricant between the bearing surfaces of machinery in order to reduce friction and prevent excessive heat, to keep wear at a minimum and prevent abrasion that might result in seizure and damage.

Any question as to the importance of lubrication can be quickly dispelled by consulting those responsible for continuous production in any large plant working on a high-pressure schedule. It is only necessary to see what happens when a single bearing in one machine fails, if that machine happens to be part of a production line. Nor is it essential that the bearing be in the machine itself, because the seizure of a boring bar in its bushing may easily tie up an important operation and with it the whole line itself.

As with any other factor that affects production, lubrication must be considered from an economic point of view. The cost of securing complete and dependable lubrication must be balanced against the losses due to machine failure from insufficient lubrication in any of the machine bearings. Machines with inadequate lubrication occasionally run for an amazingly long time, making the cost of efficient lubricating systems seem prohibitive and unnecessary. But when bearing failure does occur, as is almost inevitable, the cost of even the most expensive lubricating system frequently becomes insignificant.

Some deceive themselves as to fancied economy with the thought that bearings are inexpensive, but even where this is true the cost of replacement is frequently high, aside from the delay to production. And these delays almost invariably happen during a rush season when both men and machines are being pushed beyond normal, for just when the bearings need most attention they are apt to be neglected by men who are overly busy. It is well perhaps to consider positive lubrication as an insurance policy against breakdown in a busy season, plus its saving in repair costs on the machine itself. These costs are frequently heavy when we count moving the machine out of the production line and substituting another, if one be available.

There is also another factor that is being carefully considered by large plant managers, that of safety to the men whose duty it is to see that machines are properly lubricated. In the case of large machines such as drawing presses and the like, proper lubrication of the upper mechanisms is impossible without climbing up on top of the machine when it is not in operation. This in itself involves danger with the added probability that not all the bearings will be readily and safely ac-

cessible. The cost of workmens' accidents alone on machines of this type was a big factor in inducing one very large company to spend many thousand dollars on lubricating systems by which each bearing could be positively greased or oiled from a central point, with the oiler standing on the floor.

Another factor, that in the minds of many engineers who favor positive lubrication is of real importance, is that the bearings can be lubricated while in motion and under load. With one bearing surface in motion the lubricant is drawn in and distributed over the surfaces more thoroughly than can be done when the parts are at rest. In this way the lubrication while in motion is more thorough and consequently more effective.

In the early days of machine tool building lubrication received but little attention. Methods of lubrication, as applied to various types of machinery, have, however, improved greatly during the last decade. Improvement began in many instances much longer ago than that but the general movement toward positive and efficient lubrication is probably within that period.

Irregular Oiling Was the Rule

Harking back for forty years or over we find little beyond the oil hole drilled in the bearing cap and frequently left without covering of any kind. More careful builders supplied a plug to be removed for filling, and replaced to keep out chips and dirt. An evidence of great attention to lubrication was a small metal cup in which a bit of waste acted as a filter, and was frequently without a cover. When a cover was provided for the cup, and usually screwed on, it was thought that nothing more could be desired. These cups, however, were only for spindles and other accessible bearings. Many oil holes were so hidden by other parts of the machines that oiling was difficult even when the operators remembered that there was a place to be oiled. Oil cans with special spouts, and later with thumb-operated pumps, were devised to reach bearings of this kind. But here again lubrication depended on the memory of the operator, and memory is none too reliable in any of us.

Hit-or-miss lubrication of this type held sway until the users and builders of machinery began to realize its cost. For, up to a few years ago, many machine users were ready to testify that at least 75 per cent of all machine failures could be traced to inefficient lubrication. With this loss in mind greater attention has been given the subject and much improvement has resulted. Open oil holes gave way to covered oil cups but in most cases centralized oiling was slow in coming, and numerous oil or grease cups adorned the machines, not all of these being so conveniently or prominently located as to insure regular attention.

Flooded lubrication came into use years ago in some types of machines, where a goodly supply of oil could be carried in the base and be pumped or otherwise induced to reach the various bearings. In some cases, as in milling machines, the oil was pumped to the upper bearings in the column and flowed down over all the shafts and gears. In other machines it was piped to the main bearings and led from these to others of less importance.

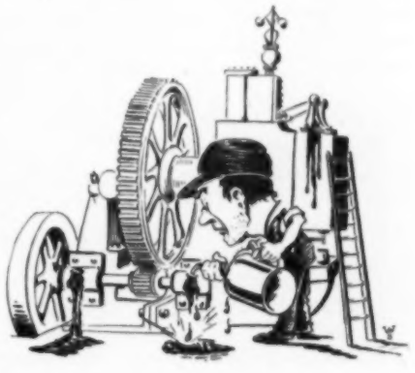
Other developments include the use of greases, forced under pressure to the bearings and in this way ejecting the old grease and any impurities of foreign particles that may have accumulated in it. The advantages of such systems are that lubricants, either oil or grease, can be led to any bearing and forced there at predetermined intervals and with any necessary pressure. In the case of large machines this is the only way in which lubrication can be assured as it is next to impossible for men to reach all the individual bearings.

Lubrication is one of the few factors in production where extreme economy of material must be guarded against rather than urged. Enthusiastic advocates of standardized methods are apt to urge the saving in lubricating costs as a reason for the adoption of certain systems or of any system. This is seldom advisable. While any good lubricating system will doubtless prevent waste of lubricant over hit-and-miss methods, the cost of lubricant is insignificant as compared with the expenses incurred by not using it in sufficient quantities. While waste of lubricant or any other commodity is to be deplored, it is usually much cheaper to use a little more than is necessary than to skimp any bearing, even slightly.

There are few places where a little more lubricant than is actually necessary is not an insurance against bearing trouble. High-speed ball bearings, however, need to be guarded against too much oil and here is where a system that delivers the right amount automatically and at proper intervals, perferably in the form of a spray or mist, is much superior to any hand operated method.

Money saved by skimping the amount of oil supplied to a bearing, however, is usually an expensive economy as many railroad shop executives of ten to twenty years ago can testify. In most cases extreme limitation of oil allowance for locomotives seems to have disappeared. But while it lasted it cost huge sums for repairs that would otherwise have been unnecessary. Railroad shop men frequently declared that "every dollar saved in oil cost ten in the repair shop."

Those responsible for high production from machine tool or other equipment are not likely to make this mistake of curtailing the supply of lubricant in order to save a few dollars. By far the greatest economy will come from an increase in production due to the larger percentage of the time that the machine is in operation. A secondary consideration is the lowered cost of maintenance and replacement due to unnecessary wear. Replacements made necessary by new developments making present equipment obsolete are another story.



The application of improved lubrication involves two entirely different consideration, one the inclusion of provision for modern lubrication systems in the design of new machines, and the other the application of such systems to machinery already built. These are usually entirely different problems nor are they as easy of solution as might appear on the surface.

Where shafts and their bearings are inclosed in the machine itself it is not difficult to supply them with lubricant. Oil can be pumped or led to as many bear-

ings as necessary, and the overflow return to a pump to be filtered and returned to the bearings. With exposed spindles, as in the vertical milling machine, it is not an easy matter to carry oil to the bearings in sufficient quantities and yet not have an annoying surplus find its way down the projecting end of the spindle. And there are many other similar cases where it is not easy to supply the desired lubricant regularly and in the right quantity. A good example of the solution of a problem that did not seem easy at first was the lubrication of the ways of a planer bed. Here, however, a surplus can be pumped at low pressure and returned to the reservoir in the bed. Lathe bed ways present a different problem due both to the form of way and the much slower movement of the carriage over them.

In applying lubricating systems to new machines, however, the designer has the opportunity to conceal oil pipe leads to bearings and to give a much neater appearance to a machine than where pipes must be fastened outside the bed and led to bearings in a conspicuous manner. But, whether the appearance can be made as neat as desired or not, many progressive firms are spending thousands of dollars to secure better lubrication for their machines, and they will demand that suitable systems be a part of all new machines purchased. No designer or builder who wants to be up-to-date can afford to neglect being informed on the latest methods of mechanical lubrication or to study ways and means of applying these methods to his machines.

Efficient lubrication will be a vital factor in deciding on the make of machine equipment to be purchased by progressive buyers. Failure to appreciate its necessity and to provide for it in new machines may easily be responsible for losing a profitable order.

As with many other developments, the adoption of complete and positive lubrication has been delayed by its cost. The users have perhaps recognized its necessity even more than the builders because a machine failure means much more in a high production plant than in one where machines are, of necessity, built in smaller quantities. In many cases users of machines have installed lubricating systems at heavy expense feeling, however, that this equipment should have been included in the design of the machine. The machine builder cannot see why the user should expect this extra value in a machine at the same price as without it. In spite of these differences of opinion there is a strong movement toward much better lubrication methods and there can be little question as to the necessity for still greater investigation and study by designers along this line.

LUBRICATION

The next two articles in this series on lubrication are by Dr. M. D. Hersey of the Bureau of Standards. He treats the principles of thick film and thin film lubrication in a way that will interest production men as well as engineers and designers.

SEEN · AND · HEARD

BY JOHN R. GODFREY

The Value of Experience—Burnishing Holes After Fly-Cutting

EXPERIENCE is a great thing. But the man who harks back to his experience of years ago in connection with present practice, is apt to find that he is a back number. For conditions have changed in many lines to such an extent as to render conclusions based on former experience of little value.

We used to know, for example, that there should be no top rake on tools for cutting brass or other soft metals. Unless the cutting edge had no rake—or even a negative rake, the tool was very apt to dig in and spoil the work. This was good practice then and still is in many places. But one of my good friends who makes cutting tools—and good ones—tells me that this is not a fundamental fact, only the result of using machines that were not sufficiently rigid. And to prove it he makes tools for brass with the same top rake as for steel when it can be used in a machine whose spindle and slides will hold the work and the tools securely.

* * *

THE question of finish for a bearing surface is still far from settled. In the days when machine spindles were light and none too accurate it was probably necessary to scrape bearings to suit the shaft that was to run in it. Then came the improved machines and reamers and the "burning-in" method, the latter heating the bearing metal until it became plastic and flowing it to fit the bearing.

Now we have, to some extent, gone back to the fly-cutter to finish the bearing, so as to insure its being concentric, and as nearly round as possible. This is a field that is now open to rather strenuous competition between the diamond and some of the new, hard, tungsten-carbide alloys. Either does a good job and can cut hard spots that sometimes exist, rather than letting these spots force the tool aside, as with a reamer. Either of these hard cutting tools leave a very good surface but does not give a burnished surface unless the tool is ground to leave a rubbing surface behind the cutting edge.

In order to secure this burnished surface some are putting a burnishing tool, really a broach with burnishing buttons instead of cutting teeth, through the hole after fly-cutting with the diamond. This gives the desired burnish, but is open to the objection that it may tend to destroy the accuracy of the surface left by the fly-cutter. To a lesser degree this is subject to the same fault as the use of steel balls to size and burnish a hole by forcing it through after reaming. The ball made a good burnisher, but unless the metal was of uniform density all around the hole, the ball rolled over the hard spots and into the soft spots, leaving a hole that was not straight all the way through. The button broach obviates much of the difficulty.

IDEAS FROM PRACTICAL MEN

The department, "IDEAS FROM PRACTICAL MEN," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit.

A Mechanical Set-Up for Finishing and Packing Small Units

BY J. S. BROWNE

AN ENTIRE group of operations, that includes the cleaning, enameling and packing of 400 Houdaille shock absorbers per hour is taken care of at the Green Island plant of the Ford Motor Company in a space only 30 ft. long and about 8 ft. wide by a special set-up of mechanical handling equipment.

The double line of continuously-operating overhead conveyor shown in the illustration was installed at the end of the assembling benches. As the double hooks travel around the end of the line at the left an operator hangs two completed shock absorbers from the assembly bench onto each hook. They then pass down the left side of the conveyor, and to enter the cleaning tank *A* are drawn up an inclined channel-iron guide. The length of the hook causes them to swing off suddenly and splash into the hot caustic soda bath. This splashing and swinging in the hot bath aids in thoroughly cleaning the oil and grease from the outside of the unit. As the case is perfectly tight none of the hot soda solution can enter and affect the working parts of the mechanism. When the parts pass out of the bath they go up another incline and drop off so that they will swing in the air to aid in the drying. The conveyor is so timed that the parts are about one minute in the soda bath and 5 min. in the air before entering the paint bath.

As the units start back on the return of the conveyor they are brought up another incline and splashed into the tank of quick drying enamel at *B*. They remain in this tank for about 15 sec., and are then drawn up an incline of wire mesh which permits the surplus enamel to drain off. From this they again swing freely in the air for about 5 min. as the conveyor carries them to the point *C* where a workman removes them from the hooks and packs them in the cases.

Only two workmen are required to operate this unit. The starting and stopping of the conveyor is controlled by a push-button near the workmen. A packing box, holding 200 units, is filled in 30 min. and is taken away

A mechanical unit for cleaning and enameling parts

by crane. The enameling tank is completely enclosed except on the ends and is connected with the exhaust fan shown above it, so that none of the solvent fumes enter the room. The overhead conveyor is standard equipment adapted to the location. The tanks were made of welded steel to suit the job.

Press Tools for Cutting and Forming Wire

By Geo. T. Kerr

The press tools shown in the illustrations are for cutting spring wire, leaving the ends sharp, as indicated at *A*, Fig. 1; bending the ends to a right angle, as at *B*; and continuing the bending process until they are formed into a U-shape, as at *C*. Fig. 1 gives front and side elevations of the tools, together with plan views of the punches and the die. Figs. 2 and 3 show the tools in the press with the ram in the upper and lower positions, respectively.

In operation, the end of the wire *D* is inserted through a small hole in a pad on top of the die-block, just far enough so that when the ram descends a small piece will be cut off by the triangular punch in the die opening of the same shape, leaving the ends pointed as shown at *A*. In the start, the small piece is wasted. After the first cut there is no small piece. As the ram continues its descent, the cam *E* in the punch holder engages the sliding member *H*, forcing it forward and making a right-angle bend in the wire, as at *B*. Further downward motion of the ram brings the ends of the cams *J* into contact with the die-plate and spreads them sidewise, the cam at the right bending the wire into a U-shape over a stationary forming block, as shown at *C*. As the ram ascends, the wire is fed by hand to the left, bringing the U-shaped bend against an adjustable stop at the left-hand end of the die-block, which completes the cycle of bending operations.

At the next descent of the ram the piece just bent is cut off, leaving its end and that of the wire pointed. As the ram continues its descent, the cycle just described is repeated, so far as

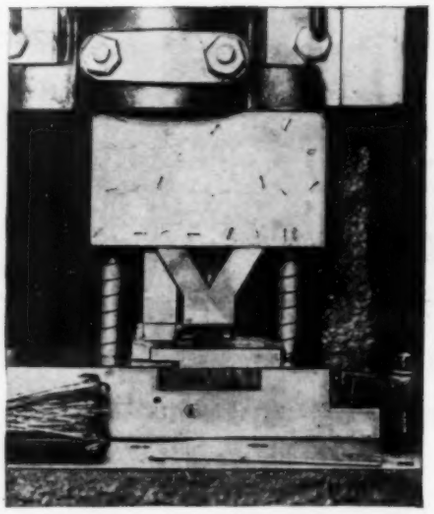


Fig. 2 — Ram of press at top of stroke with the cams in closed position. When the ram descends they separate, one bends the wire into a "U" shape, the other cuts off the one formed at the previous stroke

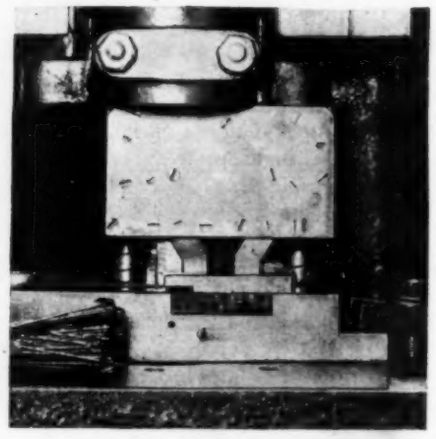


Fig. 3—Press ram at the bottom of the stroke after the rams have separated

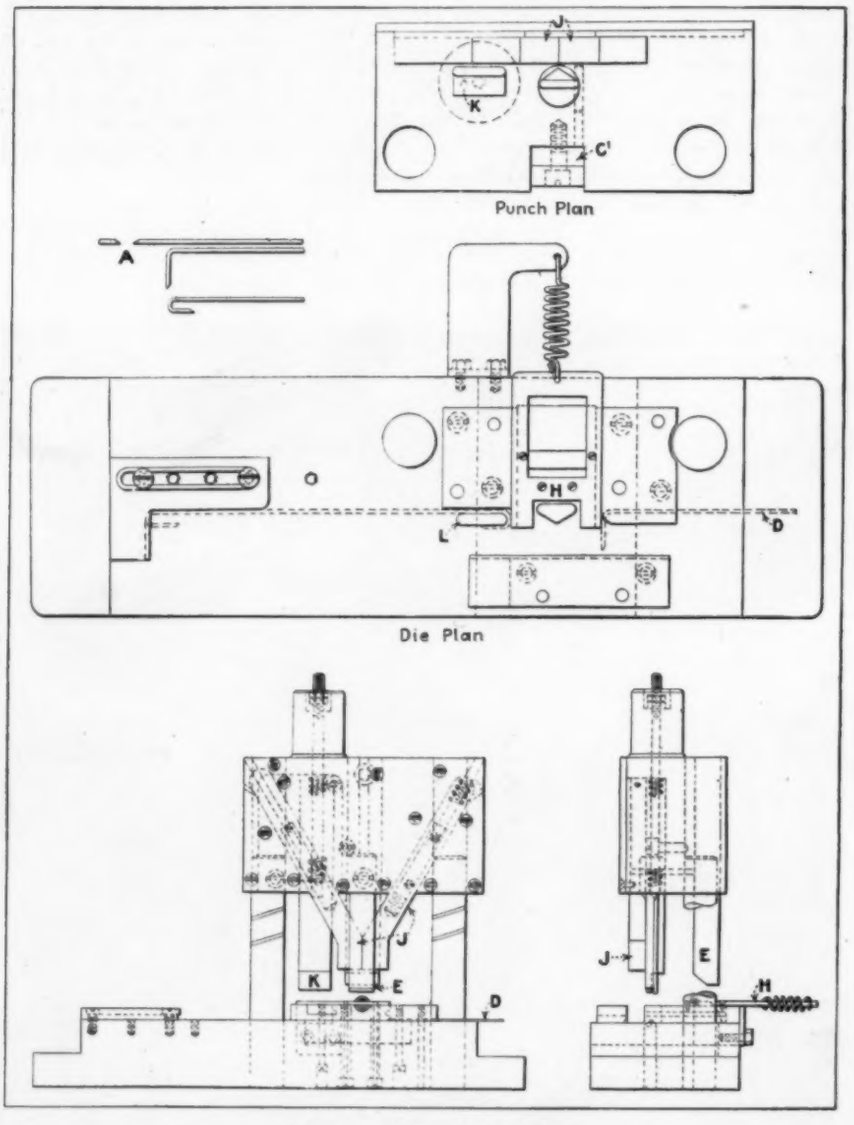


Fig. 1—Details of the tools

the wire at the right is concerned. Concerning the wire at the left, the sliding member bends the end at a right angle, the forming punch *K* enters the recess *L*, and the cam at the left bends the wire into a U-shape around one side of the punch. The work on the wire at the left is now completed and the wire at the right is left with a U-shaped bend at one end only.

As the ram ascends, the forming punch clears the U-shaped bend in the right-hand end of the wire at the left, permitting it to be removed.

After the completion of the first cycle, a wire is cut off and both ends are pointed and bent to a U-shape at each stroke of the press. The adjustable stop at the left permits wires to be formed to any length within the limits of its adjustment.

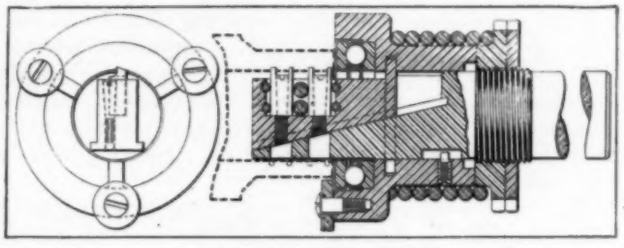
Tool for Cutting Annular Grooves

By B. J. Stern

A recessing tool for cutting four annular grooves in the bore of the casting represented by heavy dotted lines, is shown in the illustration. The work is done in a turret lathe, the casting being held in the chuck.

In operation, as the turret is advanced, the tool enters the bore of the work until the front face of the ball bearing strikes its finished face. Further advancement of the turret causes the ball bearing, backed up by a stiff spring, to bear hard against the face of the work and to revolve in unison with it, thus acting as a thrust bearing and protecting the finished face of the work from injury through friction. Continued advancement of the turret causes the toolbar to slide through the ball bearing and its housing, forcing the toolslide to move outward as the inclined part of the bar passes under it.

The two double grooving-tools mounted in the toolslide are forced out with it, cutting annular grooves in



Tool for internal grooving

the bore of the work. The tools continue to cut until stopped in their outward travel by the turret slide coming against its adjustable stop. At this time the grooves have been cut to their proper depth. By the backward movement of the turret, the operation is reversed and the tools are withdrawn from the grooves. No lateral motion of the toolslide occurs until the tools have been fully withdrawn from the grooves and their cutting points are below the surface of the bore of the casting.

The grooving tools are adjusted for depth of cut by backing screws in the toolside, which are reached through clearance holes in the toolbar, and are locked in place by taper-bodied screws. A single slot in the toolslide accommodates both cutters, the pins to be seen between them and at their sides acting as guides, thus avoiding the necessity for accuracy in cutting the slot. In the position shown, the cutters have been advanced to the full depth of the grooves.

Hardening Small Parts

By H. Moore
Ontario, Canada

Small shops often use the acetylene torch for hardening small pieces, and the accompanying photo shows a simple hardening bath device that has the desired effect of saving gas. It allows several pieces to be heated at once, if necessary, and instantly submerged. Two ordinary cans are used, one fitting inside the other. The outer or bottom can is partly filled with water and the

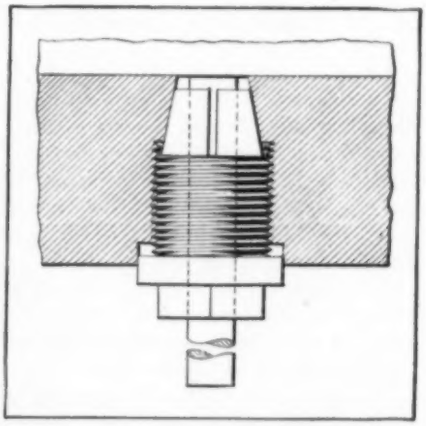
Heating and quenching small parts

second one has a sheet-metal handle and a hole cut in the center on top. In the illustration, the operator is shown about to push a heated piece through the hole where it will drop into the water. To recover the hardened pieces the inner can is lifted.

Holding Small Piercing Punches

By R. L. Haselgrove
North Harrow, Middlesex, England

Where small piercing punches are used, collets such as the one shown in the illustration are efficient time savers, especially where quick removal and renewal are necessary. The collets are drilled and reamed to fit standard sizes of drill rod. They are slit in three places on the tapered ends and are threaded on the bodies. Collars near the outer ends fit snugly into a counterbore in the punch holder and the outer ends are squared for a wrench. The punch holder is bored and subsequently



Collet for holding small piercing punches

counterbored, taper reamed and tapped to receive the collets.

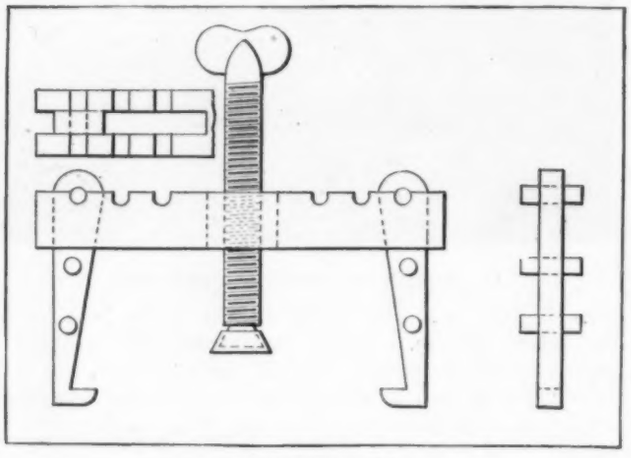
Duplicate punches can be carried in stock, so that when a punch becomes dull the collet is loosened, the punch is pulled out and a new one is inserted in its place. In such collets the punches are held firmly enough to prevent their coming out when the work is being stripped from them. They are not required to be held firmly enough to withstand the upward thrust during punching, since that thrust is taken by the punch pad.

A Clamp for Diemakers

By Charles Kugler

Many diemakers resort to all sorts of makeshift clamps for holding punches and dies together in order to scribe the outlines of the dies onto the punches, thus wasting considerable time. I, too, was guilty of such time-wasting methods until I devised the adjustable clamp shown in the illustration.

The pins in the legs and the notches in the beam permit the legs to be adjusted both horizontally and vertically on the beam, so as to accommodate die blocks of different widths and thicknesses. The utility of such a clamp will be apparent at a glance, and the time saved by its use will soon pay for the cost of making it. No dimensions are given because the clamp can be made any size to suit the average dimensions of the work in hand.



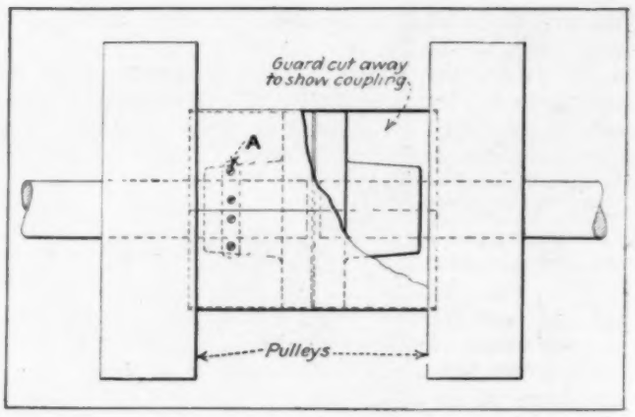
A diemakers' clamp

Guarding Lineshaft Couplings

By C. H. Hays

Sometimes it is necessary to mount a pulley next to a coupling on a lineshaft, and in rare cases to mount pulleys on each side of the coupling, as shown in the illustration. If the distance between the edge of the pulley rim and the adjacent side of the coupling flange is less than the width of the belt, the belt coming off of the pulley on the coupling side will be in danger of being caught and wound up between the coupling and the pulley. The result would probably be that either the belt would be torn in two, or the lineshaft hanger, or the hangers of a countershaft, would be torn from their fastenings. In any case, a serious accident might occur.

To avoid the danger from such an accident, the coupling should be guarded and the guard should extend well beyond the pulley rim. Such a guard can be made from two pieces of sheet metal rolled into half circles of the same radius as that of the coupling flange, and attached to the flange by countersunk-head screws. The guard can be strengthened by metal straps, such as the one shown at *A*, attached to the inside near the ends. A guard of this kind can easily be removed to give access to the coupling bolts, and it eliminates the danger of accident if the belt should come off of the pulley.



Guard for lineshaft couplings

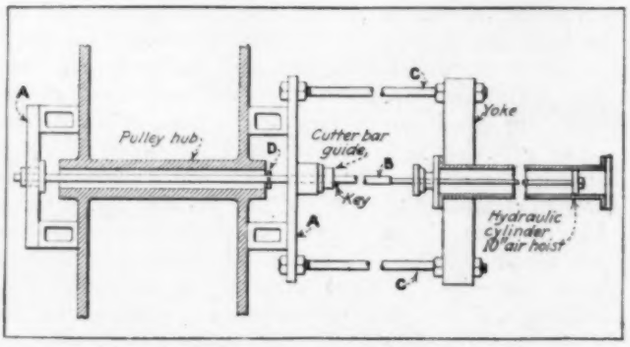
Using an Oil Cylinder as Motive Power

By A. W. Dilts

Where I was employed as master mechanic we had serious trouble with some of our heavy line shafts. This shafting was 7 in. in diameter and carried several 9-ft. pulleys. The shafting broke at or within the hub of the pulleys so often that it was decided to replace the 7-in. with 8½-in. shafting.

It was necessary, therefore, to rebore the pulleys and cut new keyways for the larger shafting. The pulley hubs were 32 in. long with arms or spokes on each end. Having neither lathe nor boring mill large enough to swing these pulleys, it was necessary to block up and bore them in place. This we did by mounting a portable worm driven boring bar on the pulley, and driving it with an air motor.

The boring operation was much simpler than cutting a new keyway 1¾ in. wide by ⅝ in. deep through a 32-in. hub. To do this we removed the boring bar, but left its bearings *A* in place. We made up a long cutter bar B, having the same diameter as the boring bar, with a keyway almost its entire length, and fitted it to the boring bar bearings. A flange, carrying a key was fastened



A hydraulic cylinder rigged up to cut a keyway

rigidly to the main bearing, which allowed the cutter bar to reciprocate but not turn.

Next, we took a 10-in. air hoist cylinder and fitted it with hydraulic packing on both sides of the piston. The cylinder was attached to the pulley by a yoke *C*, and the end of the piston rod was coupled to the cutter bar.

By using a high pressure steam pump, and an arrangement of 3-way valves attached to a common lever, we were able to pump oil to first one side and then the other of the piston, and reciprocate the cutter bar similar to a keyseater. We made three cuts with a narrow tool, then used a single tool *D* of the proper size, and finished the keyways in a satisfactory manner both as to time and accuracy.

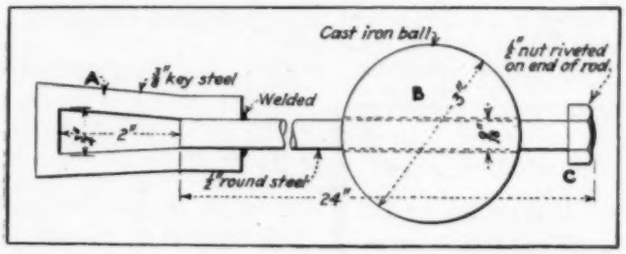
A Gib-Key Puller

By Carl M. Dinger

The illustration shows a rig which I made to remove gib keys. It consists of a loop *A* to fit over the gib, and a weight *B* guided by the rod attached to the loop.

The weight or hammer, can be either a ball as shown, or a piece of round stock with a hole drilled through it enough larger than the rod to allow it to slide freely.

The important part is the nut *C* at the end. The rod



A puller for gib-keys

can either be rivetted over, upset by the blacksmith, or welded to the nut. The puller can, of course, be made any desired size. I have pulled ¾-in. keys that had been driven with a heavy hammer, with the one illustrated.

Boring Bars for Deep Holes of Small Diameter

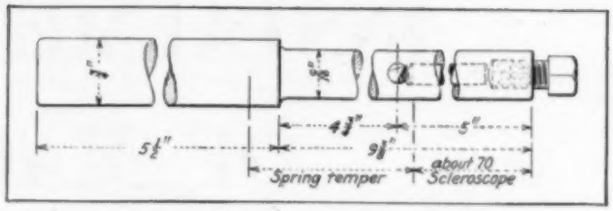
By H. J. Gustav Kopsch

In boring long holes of relatively small diameter, as is often required in turret-lathe work, I have found that bars made in accordance with the principles illustrated in the sketch are of great help. The sketch gives the actual dimensions of a bar that proved to be very strong and stiff in boring a large batch of cast iron pieces. In making such a bar, the main features are as follows:

Always fillet the corners at shoulders. Never undercut them either in turning or grinding.

Use a round high-speed steel toolbit and grind a flat on one side for the holding screw, or shoe, to bear upon. A toolbit made from round stock can more easily be ground to an accurate fit in a reamed hole in the bar than can a square toolbit in a square hole. The main reason for the round hole in the bar, however, is that it eliminates the danger from small cracks that might develop in the corners of a square hole.

The holding screw should enter from the end of the



Details of bar, giving all dimensions

bar. The usual placing of the holding screw above the toolbit, weakens the bar at that point, at which, sooner or later, the bar will bend and may break.

The bar should be drilled longitudinally from the pilot end to the toolbit, and a shoe should be placed between the holding screw and the toolbit. The longer the pilot end of the bar, the longer will be the shoe required. The use of a shoe obviates weakening the bar at the pilot end by a long, tapped hole for the holding screw. The plain hole weakens the bar but little, and if the shoe is a snug fit it actually strengthens the bar at the pilot end.

The bar should be hardened as far as the shoulder and then drawn to a spring temper from the toolbit hole to just behind the shoulder. The pilot end should be left as hard as possible, so that it will not be scored where it bears in the pilot bushing.

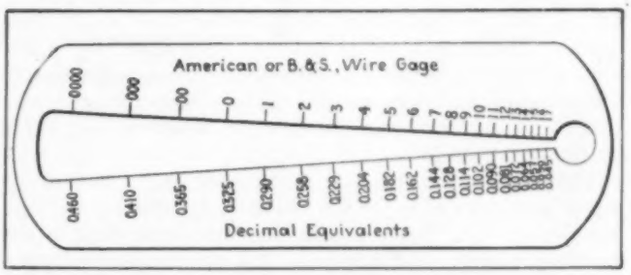
The bar can be made of alloy steel, carburized and treated to give it maximum strength and stiffness, and left hard enough to meet the requirements. All drilling and tapping should be done after carburizing and before quenching. The grinding can, of course, be done after quenching. Such a bar will probably give better results than one made from carbon steel and hardened.

Improvement in Wire Gages

By Morton Schwam

In the ordinary pocket screw- and wire-gage, the graduations on each side of the slot, on one side of the gage, give the numbers of the new and the old wire sizes, respectively. On the other side of the gage, the graduations are for screw sizes and parts of an inch in increments of $\frac{1}{16}$. Regarding this side of the gage I have no comments to make.

Regarding the wire side of the gage, however, I think it would be an improvement to reletter the new standard wire gage, making it read "American, or B & S. Wire



Suggested improvement in wire gages

Gage." Also in place of the old standard wire gage, to put the decimal equivalents opposite the gage numbers, as shown in the illustration. Since the old standard, or Birmingham, wire gage is no longer in general use, discarding it would be a blessing rather than a detriment.

INSTALMENT SELLING OF MACHINERY

As a Factor in EQUIPMENT MODERNIZATION

By H. Bertram Lewis

Vice-President,
Commercial Credit Company, Baltimore

TWO outstanding facts are of immediate interest to both manufacturers and users of machinery and machine tools: (1) That the need for plant modernization, either in whole or in part, is almost universal in American industry today; (2) That no means of financing modernization programs great or small offers greater advantages than the instalment plan to either the seller or the buyer of equipment.

Sound instalment selling may be broadly defined as a method whereby the purchaser pays down a sum sufficient to represent the initial depreciation on the merchandise or equipment and pledges himself to pay the balance in equal monthly instalments roughly proportionate to a proper rate of amortization on the investment, title to the said merchandise or equipment remaining with the seller or his assignee until the last instalment has been paid. The down payment is inadequate unless it is sufficient to penalize the buyer uncomfortably in the event of default and replevin and to protect the seller from heavy loss in the event of resale. The term of payment for the balance is too long unless the buyer's interest in the property increases and the seller's decreases at a rate equivalent to a reasonable rate of amortization based on the purchase price.

> Is it wiser for a company to finance its own instalment selling or to call in the services of a sound finance company? One of the deciding factors should be the relative rates of return on instalment paper and on money invested in the manufacturing operations of the plant. This modern tool of distribution has not been used in the field of industrial equipment to the extent its usefulness merits

The instalment principle is no new one. It has for many years been applied to household utilities of high unit value—furniture, pianos and the like—but its development since 1918 has been at a rate beyond all prior precedent, because it has met a paramount economic need of the post-war period.

The era of industrial expansion which began in America with the signing of the Armistice demanded a form of credit more flexible than the open account or single maturity note, but with equal factors of safety. The productive and consumptive capacity for a great forward movement was here, but a system of credit suited to the needs of both manufacturer and user was required to set the wheels in motion.

The automotive industry, in its usual progressive spirit, saw the possibilities of the instalment plan as applied to the marketing of its products (it had been utilized to a minor extent only prior to the War) and at once began to push instalment sales. The result is history. Other industries, chiefly in the domestic utility field, have followed the automotive lead and today all domestic goods of high unit value are being sold instalment-wise in great volume. More recently manufacturers and users of industrial equipment have caught the vision and slowly but surely the power, chemical, and machine tool industries are beginning to capitalize this most elastic and convenient form of credit.

The long-range observer, who so often views with alarm the expansion of the instalment selling principle, is usually influenced by a total misapprehension as to the amount of such paper outstanding on a given annual volume of business. Using the automotive industry as an illustration, consider the instalment outstandings on a combined new and used car retail volume of $4,000,000,000, in any single year. Forty per cent of that total would represent cash sales at the prevailing ratio. The retail cash value of the cars sold on time would therefore be $2,400,000,000. Of this sum over 33⅓ per cent would be paid down and the balance, plus the finance charge, would be carried for an average period of ten months. This means that all told, during the year, advances of $1,760,000,000 would be made to automobile purchases, a certain proportion being charged up each month throughout the year.

After the first month, however, the instalment payments would begin, and a certain amount would be credited each

month. This figure would increase up to the eleventh month, at which time, if the monthly charges had maintained a constant proportion, it would precisely equal the charges of that month and from then on indefinitely would continue equal to the monthly charges while those remained at the original figure.

The difference between these monthly charges and credits would be the outstandings, and in the case of these $4,000,000,000 worth of automobile sales the highest total outstandings would be in the neighborhood of $800,000,000. If instalment selling should cease at the end of the year this figure would be down to some $320,000,000 (eight per cent of the industry's total sales) within four months. Because of the down payment and the monthly write-off the total instalment paper owing at any one time is never a high proportion of the total sales and because of this fact, and the exceptional security afforded by the title-retaining instrument on which instalment sales are made, the actual loss ratio of instalment creditors has often been less, and never to the writer's knowledge more, than that of open account creditors in department store, dry goods and other kindred lines.

Much of the credit for this highly satisfactory credit showing belongs to the able credit and collection work of the finance companies, which have from the outset provided the funds for a major proportion of all instalment transactions. It is because of the highly specialized work required in these two departments to make the instalment principle work efficiently that the finance companies have played such a dominant part in its development. The banks are not organized to handle loans based on merchandise collateral and requiring the collection of multitudinous monthly instalments, and while manufacturers and merchants have attempted it they have almost invariably found their costs unexpectedly high, the trouble involved almost prohibitory, the demands on their bank lines inconvenient and, because of their consequent reluctance to push instalment sales, the actual effect on their volume disappointing.

Therefore a new instrumentality midway between the bank and the industry has been required, and the finance companies have thus become an essential part of the picture. The largest of these are today great international institutions, prepared to serve manufacturing clients or local merchants to the four corners of the earth.

How the Instalment Principle Can Apply to Machinery Sales

There are two practical methods of applying the instalment principle to the machinery market: (1) A plan whereby the manufacturer sells to the user on instalment terms, assigns the conditional contract of sale to a finance company, and receives in return from the finance company the amount advanced to the purchaser on instalment terms; (2) A plan whereby the finance company deals direct with the purchaser, and, after ascertaining his needs, buys the equipment direct from a manufacturer, or from manufacturers, of their joint choosing and resells it on an instalment contract to the user.

Under the first method the manufacturer has the sales advantage of offering his product on instalment terms at the very outset of the negotiations and of receiving cash in full on delivery. He pushes an instalment plan, sells on elastic credit terms, but keeps his cash at all times active in his business. Under the second plan the choice of equipment is left wholly to the equipment user and the finance company. The manufacturer of the chosen equipment makes a good clean deal—but he has no voice in the making of it. His product is bought, not sold, and if such practice should become at all general the finance companies would acquire a somewhat determining influence on the prosperity of machinery manufacturers.

Instalment Machinery Sales Seem Bound to Come

The need for a convenient and elastic form of credit in the machinery field seems obvious enough and unless something more suitable can be devised for the machinery industry the instalment principle seems certain of widespread adoption therein as soon as its availability and possibilities are generally appreciated. In some instances it is the cheapest form of credit obtainable. Always it is the most convenient for the purchaser who needs comfortable time for payment but does not need or desire to be tied up to a long term obligation bearing interest for years after the new equipment has been scrapped through obsolescence.

The writer recently discussed with a Wall Street acquaintance the relative merits, from the buyer's standpoint, of a $500,000 bond issue on a small manufacturer's modernization program and the financing of the same program on instalment terms.

A concrete case of the first sort had but recently come before this banker. It took the buyer a year to negotiate the underwriting. He received 94 for his bonds and paid 6 per cent interest on a par valuation. He transferred 33⅓ per cent of his common stock to the underwriters. The bond issue ran for twenty-five years and required interest payments, all told, of $750,000,000. When it was pointed out that on instalment terms the negotiations would have been settled one way or the other within a few weeks, with no forfeiture of common stock, that the payments would only have covered a period corresponding with the active life of the equipment and that the total carrying charge would have been but a minor fraction of the total interest on the bond issue, Wall Street threw up its hands and conceded that for a manufacturer in that position the instalment terms were in every way more favorable.

Of course, there are credit difficulties in negotiating such a transaction upon instalment terms. The risk is much more concentrated than those the finance companies are accustomed to take, and requires careful analytical appraisal. Every factor that would weigh with a banking group prior to the underwriting of a bond issue must be evaluated and a suitable instrument devised for vesting title in the finance company throughout the liquidation period. The procedure is by no means simple but in the nature of things it cannot drag as negotiations for other forms of financing often do. Because of the unremitting pressure of its other credit problems the finance company must dispose of every such proposal as expeditiously as possible, and the issue is therefore certain to be settled one way or the other without inconvenient delay for the purchaser Experience with this method of financing has not yet been extensive enough to warrant authoritative statements upon all its phases. Enough is known to justify the expectation that it will eventually become a standard form of instalment transaction and will be extensively utilized by manufacturers of moderate worth in connection with plant equipment installations beyond the

scope of their immediate cash resources. This will mean more up-to-date small plants.

How great the possibilities of instalment selling may be for any machinery manufacturer can only be determined by an open minded study of the subject, such as, unfortunately, too few such manufacturers are readily disposed to make. The industry as a whole tends towards a complex in favor of tradition and opposed to the consideration of new expedients for the solution of new problems. Granted that tradition is always entitled to high respect, it is nevertheless obvious that all human progress has resulted from a willingness to break with the old order when instruments or methods better suited to a new age have been clearly identified as such, and no period in the history of machinery production has so urgently demanded that spirit as the present. It therefore behooves the builder of machinery or machine tools to evaluate carefully this modern credit method and to make up his mind about its value in his business on the basis of analytical consideration and not on grounds of prejudice.

The machinery user, confronted with a modernization problem, great or small, has already proved his readiness to adopt the instalment principle when convinced that it best meets his needs. There is no difficulty in bringing him and the finance company together if he is, at the psychological moment, made aware of the availability of instalment terms and if a mutually acceptable credit basis for the deal can be evolved.

The important thing for all concerned just now is to spread the news that instalment selling has entered the machinery market, to urge all makers and buyers of machinery to appraise carefully its relative advantages to other forms of credit in their scheme of things, and to bring up for actual consideration by the finance companies as many concrete instances as possible in which their services may be utilized to promote machinery installations. By such means the degree of greater convenience attainable on the one hand and that of credit security attainable on the other will be determined, and the full extent of instalment's possibilities in the machinery field ascertained.

It is in the hope of hastening that development that this brief message has been written. Close students of the machinery industry maintain that a sound adaptation of instalment methods to its market would be a very godsend to maker and user alike. The finance companies, on the other hand, see much that attracts them in this form of industrial credit and welcome every opportunity to consider concrete offerings. The faster these come the sooner we shall all see clearly what grounds there are for our high mutual expectations.

Bearings and Lubrication

BEARINGS are still problems in machine design and in production. Although ball and roller bearings, unfortunately, perhaps, known as anti-friction bearings, have made their way into many fields where the plain bearing formerly held sway, there are occasionally cases where plain bearings seem to have advantages. And even in plain bearings themselves we find changes from year to year. Thick linings of babbitt in bronze shells have given way to thin linings, the theory being that they conduct the heat away from the bearings more readily than the thicker bearing shells.

Now the bronze-backed bearing is being replaced by a shell of steel, usually lined with babbitt, but occasionally with bronze, and the lining varies from $\frac{1}{32}$ to $\frac{1}{16}$ in. in thickness. The old fear of wearing through to the steel seems to have disappeared. The better support afforded by the steel seems to be a large factor in its selection. And in these days of high-compression engines, support of the bearings surface against distortion is an important factor.

Another interesting point in dispute is the method of lubricating the crankshaft, both the main bearings and the crankpins, of an automobile engine. With but few exceptions the modern engines have force feed to the main bearings, and from here the oil flows to the crankpins through holes drilled through the crank webs. A later development is to drill a small hole in the upper side of the connecting rod bearing that will match the hole in the crankpin at one point in the revolution. This is supposed to allow a small quantity of oil to shoot through the hole in the rod and up to the cylinder wall and piston pin. When it is remembered that some of the newer engines run well over 3,000 r.p.m. at high road speeds, the efficiency of this method is questioned by many. Others drill an oil hole up through the connecting rod to lead oil to the piston pin.

As opposed to the force-feed method of oil there are three well known engines, one of them running at over 4,000 r.p.m. at times, in which the main bearings have gravity oil feed and splash feed is used for crankpin lubrication. None of these engines seem to have bearing trouble, and the advocates of the system claim much for it as a means of oiling the cylinder walls and the crankpins. The rapidly running connecting rods, dipping into the oil at each revolution, produce a mist of oil that finds its way to every part inside the engine.

Another noticeable feature of the splash system is that the bearings are usually fitted with less clearance than where force feed is used. And in one instance at least, this also applies to the clearance of the piston in the cylinder. The quantity of oil produced as a spray by the rapidly moving connecting-rod ends as they splash through the oil in the trough beneath each rod can hardly fail to be many times the volume of oil that comes out of the ends of the rod bearings when pressure feed is used.

While there may possibly be danger of getting too much oil in the cylinder, good scraper piston rings take care of that, and the engines that still retain the old systems seem to give a good account of themselves. Hence advocates of both systems have the satisfaction of feeling that they are right.

In hydrogen brazing the copper is apt to run and spread itself over the surface of the metal beyond the weld. This is often undesirable, as it interferes with enameling or spoils the appearance of the part if the latter is not to be finished further. It is customary to remove this copper by sandblasting, but it can be done more effectively and at much less cost by "deplating" in an ordinary electro deplating bath.

Materials in Machine Construction

Modern high-speed machinery would not be possible without the high-strength metals that have been developed within the past few years, mostly since the War. Other notable developments in materials, which must be considered as important factors in modern design and production are heat- and corrosion-resistant alloys, light alloys, molding materials, hard abrasives, and wear-resistant and hard tool steels. Some of these developments are here listed.

Cast Irons

The competition of built-up welded steel was one of the factors that forced improvement in cast iron. Foundries are now producing fine-grained irons of tensile strengths nearly equal to machinery steel, and almost free from blow holes or hard spots. This is accomplished by pouring at high temperatures, using deoxidizers, by adding nickel and chromium, or by special mixtures. Extra hard, abrasive-resistant irons have also been developed, and by adding a high percentage of silicon corrosion-resistant castings are being made. The recent development of the X-ray method of testing castings has now made it possible to assure the user perfect castings of high-strength alloyed iron in many cases superior to the more costly malleable irons.

Ingot Irons

One of the most remarkable developments has been the almost chemically pure irons made by the open-hearth steel methods and entirely free from the disadvantages of the older wrought irons. These ingot irons, known under trade names such as Armco iron, Toncan iron, and Gohi iron, contain as low as 0.01 per cent of carbon and are made regularly in grades 99.8 to 99.9 per cent pure iron. Ingot iron is now made in sheets, plates, shapes, and bars. It is notably ductile and is corrosion-resistant. It is also made with about 0.25 per cent of copper for additional corrosion-resistance. It is especially useful for plate work.

High-Strength Steels

Nickel and nickel-chromium steels of high strength were on the market for many years, but the standardization to uniform grades and the development of maximum strengths and toughness by heat-treatments are recent developments. Alloying with molybdenum, vanadium, and other elements is also recent progress. Chrome-molybdenum steels of a tensile strength above 100,000 lb. per sq.in. are drawn into thin shapes and tubes for aircraft construction, making light structures of great rigidity that were not previously possible. Vanadium steels are also used for high strength in many mechanical parts. Deoxidizing and better mill methods have also increased the uniformity and reliability of these steels. Alloy steels of tensile strengths up to 200,000 lb. per sq.in. are used for shafts, gears and other parts, making possible lightness with strength.

Light Alloys

Tremendous progress has been made in a relatively short time in the making of strong alloys of the light metals aluminum and magnesium. Aluminum is alloyed with copper, nickel, silicon, manganese, or other elements depending on the results desired and in some cases high strengths are obtained by heat-treatment and aging. Aluminum alloys are extruded in any shape of bar or tube and can also be cast to almost any shape. Magnesium, while practically useless alone, is alloyed with aluminum and other metals and makes a useful light casting metal for moving parts of machinery that must be of light weight. Some of these magnesium alloys, when heat-treated, have a tensile strength as high as 50,000 lb. per sq.in. They are being used in automotive engine work and have great possibilities in machinery construction. Light alloys are marketed under a variety of trade names such as Duralumin, Constructal, Electron, Lynite.

Brasses and Bronzes

Though employed since remote times, brasses and bronzes have proved themselves capable of great development and improvement within the last few years. Better melting furnaces and modern deoxidizing methods have improved the uniformity and general qualities, and the re-alloying of these basic alloys with maganese, silicon, nickel and other elements has brought about great increases in strength and toughness. Manganese brasses and bronzes, for example, are regularly made of great uniformity with a tensile strength up to 85,000 lb. per sq.in., or equal to a high-grade steel. Silicon bronze also has great tensile strength and corrosion resistance. The improvement of these alloys has been of importance to the bearing field.

Corrosion-Resistant Alloys

The group of alloys containing high percentages of chromium, with nickel, iron, and sometimes cobalt or copper, has been an important recent development. They have made possible metal articles that would withstand high temperatures for long periods without scaling, thus giving great life to heat-treating boxes, furnace parts, electric furnace elements, and machine parts exposed to the action of chemicals. The steels containing approximately 9 to 20 per cent of chromium, and generally known as stainless steels, have proved invaluable for cutlery, turbine blades, and for parts that require a polished rust-resisting surface. The use of the metal chromium, itself, has been widely extended to the plating of automotive and other parts.

Molding Compounds

The use of synthetic resins for the hot molding of mechanical articles has had a tremendous impetus during the last two or three years. Formerly they were used largely for ornaments and electrical parts, but more recently they are being employed extensively to replace metals for innumerable small mechanical parts. They have entirely replaced fiber and rawhide for silent gears. There are a number of distinct materials of this class with varying physical properties, most of which can be die-molded into intricate shapes in hydraulic presses, and set permanently into a hard material not affected by ordinary temperatures, or exposure.

Miscellaneous Materials

Cadmium is a relatively new commercial metal and recently has come into prominence as a coating metal applied by electro-plating for rust-proofing metal articles in place of tin and zinc. Beryllium sold for $5,000 a pound in 1922, but is now produced for less than $50 a pound, and is employed in alloys with aluminum to produce a very strong light metal, a very small percentage of beryllium increasing the tensile strength to a high degree. Up to a short time ago Boron had no commercial use as a metal, but is now used to produce steel of extreme hardness. The action of nitrogen in steels has also been discovered and methods developed to give steels casings of extreme hardness. Recent laboratory work has also produced the hard super-cutting tool alloys such as Carboloy, Widia metal, Dimondite, and Hastellite, and the new abrasive materials such as boron carbide and tungsten carbide. Improvements in producing, grading, and bonding the artificial abrasives of aluminum oxide and silicon carbide have resulted in practically forcing the natural abrasives out of the metal-working industries. A new class of "super high-speed steels," containing cobalt and molybdenum, has placed the cutting metals on a higher plane. A new art in preparing metals, that of "diffusion," instead of alloying, has led to the development of such materials as Elkonite, which is copper and tungsten consolidated by pressing them together in powder form, and is used to replace copper electrodes in welding machines.

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Vol. 70 NEW YORK, MAY 16, 1929 No. 20

The Designer's Part in Modernization

SO MUCH has been said and written about the part played by modern equipment in the industrial prosperity of today that we are apt to overlook the equally important rôle of the designer. And that statement should not be interpreted as applying only to the designer of production equipment, valuable as his contributions have been. It applies with just as much force to the engineer who designs the product made on that equipment.

Both of these men must have a wide knowledge of the new materials that are being developed and introduced with bewildering frequency. And they must have as much familiarity with the parts and sub-assemblies that can be employed in a complete design. But the principal point that must be kept in mind is that design changes have a profound effect on production equipment—may even make it obsolete. The closest co-operation between the design and production departments is essential to successful manufacturing.

*

Mental Inertia and New Equipment

ARE we still failing to see the advantages of the new? Only a century and a half ago Benjamin Franklin asserted that it would take several centuries to populate the United States as far west as the Mississippi, and that the people would not find themselves in a condition to manufacture to any considerable degree. Franklin was a great man, one of the greatest of his time, but his judgment in this case was faulty because he did not take into consideration the mechanical means that were to make these things possible, and that were already getting a good start under his very eyes. In fact, when the wise men of the day were in session in Philadelphia drawing up the Constitution they were invited to go down to the river to see Fitch's new steam boat, and not one of them, not even the genius Franklin, thought it of enough interest to go.

The mechanical world is moving ahead today at a tremendous pace compared with what it was in Franklin's time. Is it possible that there are executives who are content to try to get out production to meet competition with the machines of ten years ago? Unfortunately, not all managers have yet learned that time is more valuable than scrap iron. When that time comes they will not hesitate to throw out obsolete equipment even if it is "serviceable," and put in faster and more accurate machines. Transportation and development were delayed forty years because wise men refused to investigate what Fitch's invention would do. Can industrial executives now hope to meet present day competition and ignore the latest advances in industrial equipment?

*

What Obsolete Equipment Costs

FIVE years ago a campaign was started in the *American Machinist* to bring home to the metal working industry the serious waste of time and money chargeable to the obsolete equipment present in almost every shop in greater or less degree. The first series of articles in this campaign dealt with the principle of replacing obsolete equipment as rapidly as possible, and the principle was illustrated by the practices of the major executives in nineteen of the most progressive plants. Next came the study of the percentage of obsolete equipment in use in the industry. And then a series of articles showing what modern equipment was doing in reducing production costs in a variety of plants.

It is most encouraging to observe the extent to which the industry as a whole has accepted the truth of the principle involved in the *American Machinist* campaign. A very considerable proportion of the present large volume of business in the equipment industries can be traced to replacement of obsolete units.

But there is still much to be done in the way of replacement. The principle has not been applied as widely as it should be. Consequently, a new series is being started in this issue to bring home to the more conservative purchasers just what it is costing them to keep their old equipment in service. It is the earnest hope of the editors that the articles in the series will convince those who have not as yet accepted the modernization principle as sound that they can afford to delay no longer.

NEWS
OF THE WEEK

Triple Mill Supply Groups Meet

A GENERAL spirit of co-operation and an endeavor to solve mutual problems of the trade was in evidence at the Triple Mills Supply Convention held at the Ambassador Hotel at Atlantic City, May 7 to 9. Simultaneous and joint meetings of the American Supply and Machinery Manufacturers' Association, the National Supply and Machinery Distributors' Association and the Southern Supply and Machinery Dealers' Association took place. It was generally agreed that the convention was the most productive of worthwhile results of any ever held. The manufacturers were more generally concerned with the problems of the jobber in their efforts to make a profit, and it is expected that a better spirit of co-operation will prevail during the ensuing year.

Training Jobbers' Salesmen

One of the problems discussed was that of training jobbers salesmen in the factories of the manufacturers so as to acquaint them with the product being sold. One of the speakers on this subject was David Jones, of the Lunkenheimer Co., who outlined the plan being successfully used by his company. The method of handling this situation by the Black and Decker Manufacturing Co. was also presented by another speaker.

The meetings of the two distributor associations tended more toward an understanding of the problems of the industries as a whole and less toward individual or sectional problems, regardless of the fact that the two groups are still split into two geographical sections and organizations. At one of the meetings of the Manufacturers Association, a plan was announced to organize the association by industries so that small groups of the 177 member companies can get together and discuss their common and intimate problems. For example there would be a power transmission machinery group, a bolt, nut and rivet group, a lathe chuck group, etc. A complete reorganization of the association is under way, including a revision of the constitution.

Several addresses were made bringing out the relation between the manufacturer and dealer in mill supplies, and most of the discussion centered around the spirit of co-operation between the groups, although no attempt was made to reopen the subject of complete amalgamation of the three groups under one association.

An invitation was given by M. Markham Flannery, Director of the Trade Practice Division of the Federal Trade Commission, to the mill supply group to participate in a trade practice conference with the Commission. In outlining this offer, Mr. Flannery explained that the procedure would be virtually the same as followed several years ago when the commission rescued the motion-picture industry from a chaotic state of affairs. Under his plan each of the companies engaging in the manufacture of machinery and supplies would appoint a representative who would confer with the commission relative to proposed trade practices.

At the end of the session David Jones, of the Lunkenheimer Co., Cincinnati, was elected president of the American Manufacturers' group; H. H. Kuhn, of the Hardware & Supply Co., Akron, Ohio, president of the National Distributor's Association, and D. D. Peden, Peden Iron & Steel Co., Houston, Tex., president of the Southern Dealers' group.

* * * *

U. S. Chamber Adopts Resolutions

RESOLUTIONS dealing with the credit situation, agriculture, reduction of armaments, railroad rate-making, merchant marine, legal procedure, taxation, tariff, import and export prohibitions, immigration, commercial aeronautics, the mineral industries, passports, trans-Pacific press messages, distribution studies, the forest reserves, highway appropriations, traffic regulation, daylight saving, fire waste, health conservation, and accident prevention were adopted at the final session on May 3 of the seventeenth annual meeting of the Chamber of Commerce of the United States held in Washington.

Julius H. Barnes was selected as the chairman of the board of directors for the ensuing year. William Butterworth was re-elected to the presidency of the organization. Among the vice-presidents W. Rufus Abbott, of Chicago, was elected to represent the North Central States and Charles W. Lonsdale, of Kansas City, the South Western group. The vacancy in the North Western vice-presidency was not filled. The other vice-presidents were re-elected as follows: Robert R. Ellis, of Memphis, South Eastern States; Alfred J. Brosseau, of New York, North Eastern States; and Paul Shoup, of San Francisco, Western division.

The resolutions dealing with the credit situation acknowledges the difficulty of preserving the orderly balance of finance and credit under new conditions. It urges that the capacity of the country to absorb new security be weighed carefully. "Basic industries," says the resolution, "especially the smaller units of manufacture, distribution and agriculture, should not be burdened with unusually high interest rates resulting from security excesses." The Chamber, however, expressed full confidence in the ability of the Federal reserve system to adapt itself to new conditions and besought for it the utmost co-operation.

In its resolution on agriculture the Chamber stood unqualifiedly for equality in tariff protection between agriculture and manufacturing industries. It favors a new federal agency to deal with these problems and it was recommended also that the Chamber should have a committee of its own for the sole purpose of following the work of the farm board.

The contract principle should be applied, the Chamber declares, to assist in completing the disposal of the Shipping Board lines and at the same time provide for the development of overseas shipping services, including the movement of the seasonal peak of traffic. The function of the Shipping Board thereafter should be that of an agency to carry on the regulation of the relation of merchant shipping to the public.

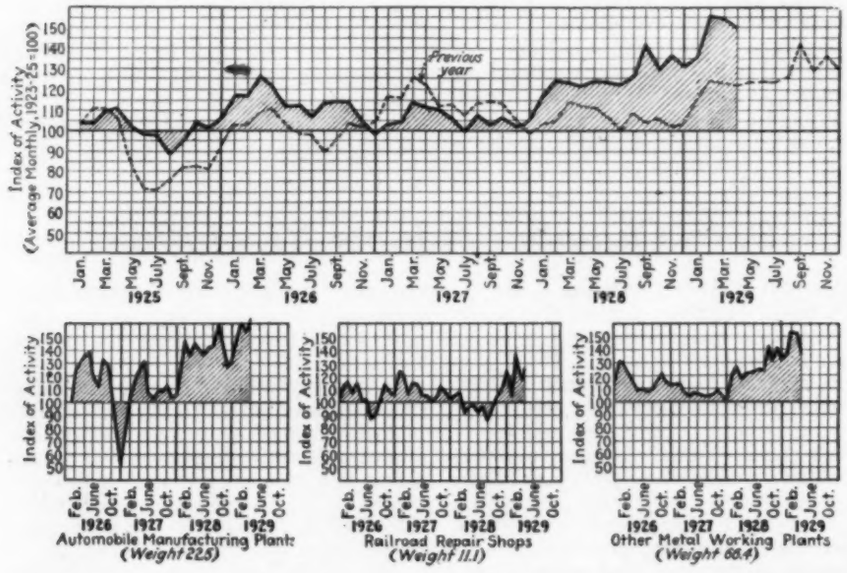
The Chamber expressed a desire that the established Tariff Commission "should be strengthened by the necessary authority for expeditious determination of those questions with full responsibility under the President." Prompt ratification of the convention for the abolition of import and export prohibitions and restrictions was urged in another resolution.

"Congress should provide more adequate appropriations for detailed, co-operative distribution studies with those fields of industry which are interested." says another of the resolutions adopted. The establishment of airports and the encouragement of the use of aircraft was urged. Unqualified support was pledged to the President and the Federal Government in every effort looking to the suppression of war as an instrument of national policy.

Industrial Activity Declines During April

Incomplete reports on the consumption of electrical energy by the metal-working plants of the country indicate that during April there was a seasonal decrease in the rate of operations of about normal proportions. The April rate of activity in these plants was 4.7 per cent under that of March, and 8 per cent under the peak of operations recorded in February, but was still 12.6 per cent over April last year.

A more than normal seasonal drop was recorded by the metal-working plants other than the automobile and railroad shops. In this large branch of the industry a drop of 9.7 per cent was recorded during April as compared with March, but operations in these plants were still 12.4 per cent over April last year.


Index of Activity (Average Monthly, 1923-25=100)
Previous year
Jan. Mar. May July Sept. Nov.
1925 1926 1927 1928 1929
Index of Activity
Feb. June Oct.
1926 1927 1928 1929
Automobile Manufacturing Plants (Weight 22.5)
Railroad Repair Shops (Weight 11.1)
Other Metal Working Plants (Weight 66.4)

On the other hand, the automobile industry, including the manufacture of parts and accessories, reached a new record rate of operations during April. The April rate of activity in these plants according to the incomplete returns was 4.4 per cent above the March figure, and 8.6 per cent above April last year. It was just slightly above the previous high average rate of monthly activity set during the current February.

Railroad repair shops appear to be operating on a comparatively high plane, the April rate of operations being about 27 per cent above that of April last year.

* * *

General Electric Adopts Vacation Plan

A new plan whereby factory employees of the General Electric Co. with a record of three years or more of continuous service will receive one week's vacation with pay, and employees' with a service record of ten years or more two weeks vacation with pay, has been announced by C. C. Chesney, vice-president and chairman of the manufacturing committee of the company. Absence of more than thirty working days during the calendar year preceding the year of vacation for all personal reasons shall be considered as a break in the employees' regular attendance record and in such case, he will receive no vacation. All reasons will be considered personal ones except absence due to lay offs and lack of work, jury duty, military duty, and attendance at military training camps. The vacation season will extend throughout the year.

The company also announces that it has awarded $62,381 to 5,627 of its employees during 1928 for their suggestions tending to improve working conditions or increase the efficiency of the company's operations. During the year, 18,077 suggestions were offered, an increase of 3,000 over the previous year, and of these, more than 32 per cent were accepted. The largest award was $1,200, given to an employee in the Schenectady Works for his suggestion of means of improving the manufacture of General Electric refrigerators.

* * *

S.A.E. Summer Meeting at Saranac Inn

An attractive program of meetings and amusements is being planned for the summer meeting of the Society of Automotive Engineers, to be held at Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Special trains are being run from the leading cities. On the first day there will be a standards session, a business meeting and a business of engineering meeting. On Wednesday, the 26th, there will be sessions on combustion, motor truck design, and design of bodies. The following day sessions on transportation, airships, and mixture distribution are scheduled. The last day, Friday, May 28, will be devoted to research discussions on the subjects of fuels, headlights, riding qualities and front wheel alignment.

Programs of Expansion All Over the Country

Every week sees new programs of industrial expansion announced in all parts of the country. This week there has been a particularly large number of plant expansions due to increased demand for the equipment manufactured. For convenience, they are listed below:

The Formica Insulation Co., 4614 Spring Grove Ave., Cincinnati, Ohio, has begun construction on an additional unit to its factory containing 25,000 sq.ft. of floor space and including a new office and administration building. As the plant was running for 24 hours a day during April and May, an effort is being made to get the new building in shape for production before the first of July to take care of the demand.

The Walsh & Weidner Co., subsidiary of the International Combustion Engineering Corporation, Chattanooga, Tenn., manufacturer of boilers and power plant equipment, has started the construction of a one-story 200x60-ft. addition to the machine shop. An investment of about $50,000 is being made in the plant, not including machinery and equipment.

Leeds & Northrup Co., Philadelphia, Pa., has secured 190,000 sq.ft. of additional property on an adjoining site, including approximately 85,000 sq.ft. of additional floor space in a modern one-story building of saw-tooth construction. The building will be used for increased manufacturing facilities, due to a rapid expansion of business.

The Service Tool, Die & Manufacturing Co., of Chicago, now located at 2256 West Walnut St., is erecting a building of approximately 15,000 sq.ft. floor space at 4625 West Fulton St., at a cost of about $65,000 to provide additional space for the installation of production machinery. Carl Danielson is president of the company.

The Ontario Steel Products Co., Ltd., has decided to spend approximately $200,000 upon an extension to the bumper and spring plant at the Dowsley Spring & Axle Co. division at Chatham, Ont. The contract for the building has been let and contracts have also been let for furnaces and other equipment. The plant will be in active production by the first of October.

The Texas & Pacific Railway Co. plans to start the construction of new machine and repair shops at Big Spring, Tex. in the near future, it has been announced by E. F. Mitchell, chief engineer of Dallas, Tex. An investment of about $100,000 is to be made, including equipment.

Expansion of the Tri-City Farmall Tractor plants of the International Harvester Co. in Moline, Ill., which will mean eventual employment of a force of 2,000 men and doubling the present output, was announced this week by E. H. Sohner, general manager.

The Goddard & Goddard Co., Inc., of Detroit, manufacturer of cutters for milling machines, has just broken ground for a new factory and office building of modern construction on its 8-acre site on Burt Road. The office will be a two-story building, while the factory will be a one-story type. The floor area will total 47,000 sq. feet.

Two additions will be erected within the next few weeks at the Salls Brothers Co. plant, Rockford, Ill., to provide for an increase in business. The firm makes castings, patterns, oil distributing equipment and automobile heaters. One unit, two-stories high, will be 66x145 ft. and the other, one-story, 56x93 feet.

Additions are being erected to the premises of the Allard Machine Works, New Westminster, British Columbia. The machine shop is being rearranged to allow for installation of additional equipment, and a pattern shop and store room is being added.

The Canadian Drawn Steel Co. Ltd., Hamilton, Ont., having just completed a large addition to their rough stock room, find it necessary to extend again and are putting up another building with a view to rearranging the layout of their machinery.

The Canadian Lift Truck Co., with general offices in Montreal has recently opened a new plant in Toronto. This company reports that business so far this year has established a record.

* * *

Automobile Production Still at High Level

Maximum production schedules are still in effect at most American automobile factories and indications are that there will be no immediate recession in the present high rate of output, according to *Automotive Industries*. From early figures it appears possible that a new record in the manufacture of automobiles and trucks was established last month. The Ford Motor Co. announces that its April production reached a total of 190,388 cars and trucks compared with 181,894 units in March and 125,984 units in February. Ford production is likely to remain high during May, and the Chevrolet plants are expected to turn out 160,000 cars and trucks. Several other major producers also plan increases in output this month.

Foreign markets took 21.4 per cent of the American motor vehicles sold in March, according to figures compiled by the National Automobile Chamber of Commerce. Production of all companies during April, based on factory shipments, was estimated to be 633,424 cars and trucks compared with the March total of 625,372 and of 430,783 for March of last year. An increasing number of trucks are being sold outside the United States, the percentage of the total truck production having risen from 41.3 in January to 51.6 in March.

Higher Duty Proposed on Electrical Machinery

To correct the inequalities in the present tariff law governing the importation of electrical machinery and apparatus, the Ways and Means Committee, in the tariff bill introduced in Congress on May 7, has set up new classifications governing these imports. In the present law, transformers, wiring devices and control apparatus are dutiable at 40 per cent *ad valorem* as manufactures of metal. Generators and motors, which are more expensive and more difficult to manufacture, and which are subject to keen competition, are assessed only 30 per cent *ad valorem* as machines. In addition, the interpretation of the word "machine," as applied to electrical equipment, has resulted in transferring certain equipment to the basket clause of the metals schedule. In order to provide more adequately for electrical equipment, a new paragraph is proposed:

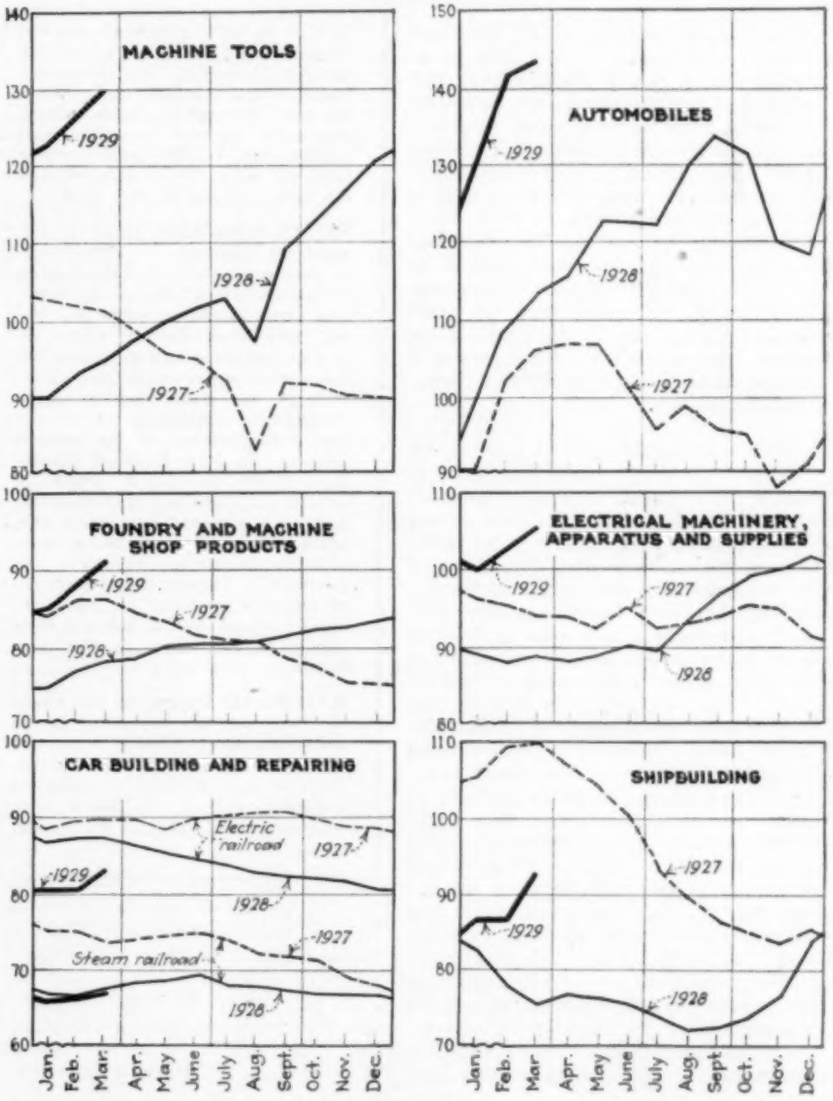
"All articles suitable for producing, rectifying, modifying, controlling, or distributing electrical energy; electrical telegraph, telephone, signaling, radio, welding, ignition, wiring, therapeutic, and X-ray apparatus, instruments and devices; and articles having as an essential feature an electrical element or device, such as electric motors, fans, locomotives, portable tools, furnaces, heaters, ovens, ranges, washing machines, refrigerators and signs; all the foregoing and parts thereof, finished or unfinished, wholly or in chief value of metal and not specifically provided for, 40 per cent *ad valorem*."

* * * *

Trend of Employment in the Metal-Working Industries

Data supplied by the Bureau of Labor Statistics

Monthly average for 1923 = 100



BUSINESS BAROMETER

Acute credit stringency has apparently proved an effective damper on present stock trading

By THEODORE H. PRICE
Editor, Commerce and Finance, New York

THE corrosive effect of high interest rates upon security values is gradually becoming visible in the stock market. Some of the stocks that are regarded as speculative leaders spurt up occasionally, but the market is an irregular one, and it is plain that many of the smaller holders are liquidating from day to day.

Recognizing this situation a prominent New York banking house has issued a survey in which it is stated that the "acute credit stringency with its attendant high rates for both time and call money has apparently proven a most effective damper on the activities of those who distribute investment securities."

The survey goes on to say that "the unusual combination of a falling bond market and a rising stock market has accelerated heavy commitments in stocks on the part of the American investor, and his interest in securing speculative profits has displaced, at least temporarily, his more sane and logical sense of proportions investment-wise."

Meanwhile, there is a widening divergence of opinion with regard to the limitations that should be imposed upon the use of credit, and the lines which separate the fundamentalists in finance from those who might be called modernists are being more clearly drawn from day to day.

The fundamentalists still cling to the philosophy of thrift, whose maximum is that "a penny saved is a penny gained," whereas the views of the modernists are aptly stated by Mr. Raskob in an interview in which he asserts that "next to the responsiblities of a wife and family, nothing helps to develop young men more than to get into debt in making wise investments, which constitute a powerful incentive to save continually."

This interview was published in connection with an announcement that Mr. Raskob had under consideration the formation of a huge investment trust, with a capital of five billion dollars or more to be supplied by the wage-earners of the United States upon the installment plan. The complete details of this plan have not yet been worked out, but the publicity given to it and the seriousness with which it is being considered in some quarters gives point to the claim that we are developing an investment banking system that will be independent of the regulations and restrictions that are now imposed upon the banks and financial institutions that have hitherto been the custodians and guardians of credit officially recognized in the United States.

It remains to be seen whether this new philosophy of finance will be workable, but it is to be feared that some of those who are carrying securities on margin will grow weary while waiting for a determination of the question at issue.

In so far as the immediate future is concerned, a revival of speculation seems to be unlikely. Hence the comparative softness of the stock market and the extreme weakness of some of the commodity markets, particularly the grains.

Rubber is an exception to the trend in that it has advanced. Sugar has been quite active upon the announcement that the new tariff bill included a provision which would raise the duty on foreign grown sugar to 3c. a pound, and the preferential rate on Cuban raws to 2.40c a pound.

There are many who think that this increase in duty means the destruction of the sugar-producing industry in Cuba.

But the tariff bill has not yet passed, and it is possible that many changes will be made in it before it becomes a law. As promised during the election campaign, some of the bill's provisions have been included in the interest of the farmers. But it seems unlikely that they will have much effect upon the prices of those agricultural products that we export.

Meanwhile, it must be admitted that the debate over farm relief and the tariff has had surprisingly little effect upon business in the United States. It is not quite as active as it was, but it is still upon a very high level, and both industry and trade will recover any ground they have lost if an adjournment of Congress is not too long delayed.

Steel output is still at the practical capacity of the industry, and the enormous sales surprise the few who still talk about a saturated market for motor cars. A falling off from the record production is inevitable, but it is not yet visible.

The news from abroad is rather more reassuring than it was last week. There now seems to be a chance of settling the Reparations question, and there is no doubt that its settlement would have a stimulating influence upon business throughout the world. But much depends upon whether the British elections to be held May 30 will show that John Bull intends to adhere to the financial conservatism by which his domination of the world's trade has been attained and preserved.

From this page the reader will get a quick picture of current business and industry. The boxed material below is a summary of the letters from regional correspondents of the American Machinist, published in full on the opposite page.

NEW ENGLAND reports a slight but consistent downward trend in the sales of machine tools and machinery in the last week, and in Detroit there has been a noticeable tapering off in machinery sales, said to be only a normal seasonal drop. In all other parts of the country, however, no downward trend in the machine tool market has been noticeable. Sales in such important centers as Cincinnati continue at a high level, coming from all parts of the country, and the local demand is still good.

NO DOWNWARD trend is noticed in Chicago in either new or used equipment, and there is no indication of a let-up in sight. The same condition holds true for the New York district, where inquiries are large and prospects being worked upon are in such quantity as to make dealers there exceedingly optimistic as to the future continuance of the present activity. In New England, despite the slight downward trend in orders, inquiries are also plentiful and it is expected that sales will again rise as soon as the present delivery situation becomes improved. In Detroit the installation of power equipment by the automotive plants would indicate shop expansion to follow in the near future.

RAILROAD buying on the whole has been steadily improving in the past month, particularly in the Chicago district. Cincinnati reports a fair amount of sales to railroads, and in the South also, railroads are a factor in the buying.

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16 Exchange Place, New York

THE INDUSTRIAL REVIEW

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

CINCINNATI

Machine tool manufacturers in the Cincinnati district report that in the past week business continued at an excellent level. In a small number of cases it was reported that a little less business was booked than in the previous week, but this loss was more than offset by increases had by others, and taking the trade as a whole there was a gain in sales.

Selling agents report that in the week there was a good demand in local and adjacent territory, with more than a little upward market tendency. The principal business being developed by this branch of the trade at this time is the replacing of obsolete tools with modern types of greater efficiency.

With the manufacturers the sustaining feature of the past week's market was the sale of single tools and replacements to general machinists and miscellaneous users. Orders booked came from all sections of the country and were well diversified as to sizes and types. In the aggregate there was a fairly large amount of buying by railroads, but none of the orders reported were large. Orders from the automotive field were to a great extent confined to single tools.

Manufacturers report that the week's inquiries were large in number, well scattered over the country and of excellent tone. Inquiries coming from the automotive industry are taken as an indication that a larger volume of business is about to come from that field.

DETROIT

There has been a noticeable tapering off in the machinery and machine tool business here for several weeks, and that tendency has continued during the past ten days. There is no immediate prospect of an improvement, but most dealers believe this is altogether a normal early summer condition and they predict a return of good business in the late summer.

It is reported from several sources that some of the larger automobile manufacturers are making increases in their power equipment which seems to indicate future expansion. Whether or not this actually means that a large amount of new equipment will be sold to these firms later in the year can only be surmised, of course, as none of the big manufacturers have revealed their plans. Right now the bulk of the business is coming from changes on the many new models that have been brought out and are being brought out. There is also a great deal of replacement buying. There is little in the way of expansion in progress now in the motor industry. The airplane field is holding the public attention here now and though several large new developments are in progress they have meant little to the machinery trade thus far.

A large amount of machinery is being sold for construction of various kinds. The small tool and die shops continue to be very active and all of them are in the market for machinery and tools of one kind or another. The shops are probably busier than they have been in many years, and their orders indicate that they will continue to prosper for at least the next few weeks and probably longer.

Some of the dealers are beginning to catch up on their orders, which in many cases were months ahead of deliveries. As a result of this inability to get equipment many of the houses here have been unable to get business and this has seriously cut down gross sales. In spite of that the receipts have been perhaps better this year than during any year in the history of the industry.

The Detroit industrial area is more prosperous than it has ever been. Employment is at an unusually high point and almost all businesses feel the general pressure of healthy buying.

NEW ENGLAND

The slight though consistent downward trend in the New England machine tool market was again apparent through the current week. It continues to be more noticable in the used than in the new machinery field. Some dealers report an appreciable lower volume of business than last week. A pertinent fact in explanation of this order decline is seen in the fact that good guaranteed deliveries bring immediate orders; also first-class used machinery holds a ready market, but those units are scarce. The present lull is more certainly due to the great volume of unfilled orders, and resulting long deliveries, than to an abatement in demand.

Inquiries substantiate this general belief. During the week lists were plentiful and asked for figures on turret and engine lathes, totaling a dozen tools, heavy-duty grinding units, presses and drills. Orders for the week included six lathes to a Connecticut builder, screw machines, a shaper and a number of drills. Bids were received for manual training equipment for a Springfield school.

Aeronautical progress in New England is promising, and airplane manufacturing has stimulated the machinery industry. Development is approaching the point where further progress, and by far the greatest progress, must come through the commercial utilization of aircraft by industries as a potent business factor.

A Naugatuck airplane engine manufacturer has tested a new engine successfully and anticipates production shortly. The Charles Parker Manufacturing Co., Meriden, expects to contract soon for the production of airplane wings.

SOUTHERN DISTRICT

Though unfavorable weather has adversely affected machine tool and equipment business in the Southeast the past two weeks, volume continues to hold its own compared with April of this year and the corresponding period last year. Conditions, however, are inclined to be spotty, the demand being extra heavy from some of the industrial buyers and rather light in other fields.

The textile and affiliated industries are the best buyers, with general equipment demand the heaviest in years because of the large amount being invested by mills in new plant construction in the Southeast, and demand from textile mill machine shops better than normal. Sales are also showing steady improvement in the railroad field, and some sizeable orders for heavy equipment have been recently reported from larger roads for shop projects now under way.

On the other hand, sales to the lumber, furniture and kindred woodworking industries are slow nearly all over the South, running considerably less than at this time last season. Inquiry is also slow and outlook not considered very promising in the near future. Contractors and road builders are placing larger orders than at any time this season, but due to the inclement weather in the Southeast since the first of the year this business to date is not up to the corresponding period in 1928, though the late spring and summer outlook promises a much better demand from this source.

No change is noted in the demand from smaller machine shops, garages and similar buyers, and though some orders are being booked they are comparatively small and for the most part either for used or rebuilt equipment, with hardly any call for new machinery. Inquiry is also quiet and outlook indicates no early change.

CANADA

The structural steel business is at present one of the busiest branches of the metal-working industry in Canada and from all indications there will be sufficient work to keep all plants employed at or near capacity during the greater part of the year. New bridge contracts continue to be a large feature of the market. The Canadian National Railway has decided to proceed with the erection of a new terminal station at Montreal, which will involve a tremendous expenditure for structural steel. The Dominion Bridge Co., Ltd., has been awarded the contract for structural steel for the new marine building at Vancouver, the contract totalling $250,000. The Sarnia Bridge Co. also has enjoyed a good volume of business since the beginning of the year and is planning some extensions to the present plant.

Construction volume for the year to date in all parts of the Dominion now stands 12 per cent ahead of that for the corresponding period in 1928.

The Goodyear Tire and Rubber Co. is reported to have set aside an amount of $850,000 for machinery and equipment to be installed in its plant at St. Hyacinthe, Quebec.

Demand for agricultural implements continues strong. Operations at the plants of the Cockshutt Plow Co. have been running at a very high rate of activity. Early in the year the company received a particularly large order for export, and this has been the chief factor in expansion in output.

The railroads are still placing extensive orders for rails and other equipment and, according to the branch-line construction program already announced, the volume of business from this quarter will establish a record before the year is ended.

CHICAGO

Thus far this year, business in machine tools has shown no downward trend, and none is expected by men prominent in the industry, at least until the usual seasonal recession beginning in July. Demand for all types of tools continues good. Local representatives of machine tool builders, especially of milling machines, automatic screw machines, lathes and grinding ma-

chines, see no early let up in the call for their products. Deliveries in some lines are improving, but, in the main, from six weeks to three months are required to fill orders for heavy-duty machinery.

At this time, some of the larger industrialists are the principal factors in the market, but buying by automotive and automobile accessory interests still remains at a good level. The latest railroad to enter the market, the Union Pacific, has just issued a substantial list for new shop equipment. This comprises about twenty-five units of various types, lathes, grinding machines, and bending machines leading.

Demand for used tools in first class condition shows no indication of waning, and dealers in this class of equipment admit they are realizing prices that six months ago would have seemed almost prohibitive. Delayed deliveries on orders for new tools is said to be accountable for much of this business.

NEW YORK

Little change has taken place in the trend of sales of machine tools in the New York market during the past week. The same high level of activity that has characterized this district since the first of the year and before, is still reported by dealers and manufacturers' representatives almost without exception. From the volume of inquiry being received and the number of live prospects being worked upon, there is every reason to believe that this activity will continue for several months to come. Little or no improvement has taken place in the delivery situation, although it is noticeable that a few of the leading tool companies, who were able to anticipate present demands, have been able to lessen the time between receipt of orders and delivery of machines by increasing their plant capacity some months back.

Companies selling to railroads report that the general situation has improved materially in the last few months, although the local situation is rather dull. No action has been taken by the D., L. & W. R.R. on its list, issued a month or so ago, and buying by the New York Central, usually very steady, has noticeably declined in the past month.

Sales of machine tools continue to be well scattered and in small units. The large buying started by the Lycoming Manufacturing Co. several weeks ago has been about completed, but the Western Electric Co. and the General Electric Co. continue to feature in the market.

Sales made by the Triplex Machine Tool Co. are indicative of the general trend, as follows: one 14-in. Springfield toolroom lathe, one Oesterlein toolroom miller, a Boley multiple drilling machine, three filing machines, a sensitive drilling machine, and seven flexible shaft grinding units.

* * *

Machine Tool Orders Show Slight Decline

Although the index of three-month averages of machine tool orders still continues upward, there have been slight declines in the monthly figures for the past two months, according to the National Machine Tool Builders' Association, and a seasonal recession is expected. Shipments still continue to lag behind orders. The index of unfilled orders is 718, while the index of shipments is 311, indicating an approximate backlog of orders of about two months. The basis of the index figures is average figures for 1922-23-24. The index of orders, three months' average, is now 330, indicating a volume of business over three times that of the period mentioned.

Business Items

The general offices of the Foote Bros. Gear & Machine Co. of Chicago will be moved from the present address at 215 N. Curtis St. to 111 N. Canal St. During the past year the company acquired three large firms engaged in the manufacture of tractors and graders. These companies have been organized into a new division of the Foote Bros. Gear & Machine Co., known as the Road Machinery Division. They were formerly known as the Northwestern Steel & Iron Co. of Minneapolis, the Bates Manufacturing Co. of Joliet, Ill., and the Stockland Road Machinery Co. of Minneapolis. All executive control and clerical departments of the Road Machinery Division have been taken over by the Foote Bros. Company. The new quarters provide about 27,000 sq.ft. of office space.

Boeing Aircraft, Ltd., of Canada, recently formed by the merger of the Hoffar-Beeching Shipyards, Ltd., with the Boeing Airplane Co., of Seattle, Wash., will establish an airplane factory in Vancouver. W. E. Boeing, of Seattle, will head the board of directors of the new firm. Immediate extension of the Hoffer-Beeching shipyards and the construction of BIE flying boats are early plans of the company.

The Minneapolis-Moline Power Implement Co. has been chartered under Delaware laws to acquire the assets of the Minneapolis Steel & Machinery Co., the Minneapolis Threshing Machinery Co., and the Moline Implement Co. The companies have plants in Minneapolis, Hopkins, Minn., and Moline, Ill. A public offering of convertible preferred stock and common stock of the company will be made soon.

The Ideal Commutator Dresser Co., of Sycamore, Ill., has moved its New York office and warehouse from 164 Nassau St. to 18 Warren St., where larger quarters are available to take care of increased business. R. W. Becker is in charge of the office as Eastern division manager, and F. J. Greyfuss as New York district manager.

The Apex Tool Co., Inc., Bridgeport, Conn., has incorporated to manufacture metal-working tools and machines with an authorized capital of $50,000. The incorporators are: S. B. Swanson, D. J. Swanson and Sven Swanson, all of Bridgeport. The company continues the business of the same name.

The Fafnir Bearing Co. of New Britain, Conn., has added two wings to its plant, increasing its floor space nearly 50 per cent to a space of nearly nine acres. This addition will be used to increase production of the ball bearing spring shackles introduced by the company last year.

The Alemite Manufacturing Corporation, of Chicago, has purchased the line of industrial lubricating equipment bearing the Dot name, and will continue its manufacture and sale. The Carr Fastener Co., of Cambridge, Mass., which formerly manufactured the Dot Lubrication System, is now concentrating on the manufacture and sale of the Dot line of fasteners.

The Perine Machinery Co., Inc., of Seattle, Wash., has moved to new quarters at First Ave. & King St. W. H. Payne and F. W. Fuertel are the new owners of the company, which is agent for the Oliver Machinery Co., of Grand Rapids, Mich.

Takata & Co., Ltd., of Tokio, Japan, dealers in machinery and supplies, have moved from No. 1 Yaesucho Itchome to No. 6, Marunouchi Nichome, Kojimachiku.

The Saginaw Stamping & Tool Co., Saginaw, Mich., has opened a branch office at 1005-6 Transportation Bldg., Chicago, Ill., under the management of George E. Johnson.

The Wright Manufacturing Co., manufacturer of Wright chain hoists and trolley cranes, recently moved its New York office to the New York Central Building, 230 Park Avenue.

Clifton Reeves & Associates, industrial engineers, have removed their office to 95 Liberty St., New York, N. Y.

Personals

MARCUS T. LOTHROP has been elected president of the Timken Roller Bearing Co., Canton, Ohio, succeeding H. H. Timken, who becomes chairman of the board. Other officers elected were W. R. Timken, J. G. Obermier, J. W. Spray, T. V. Buckwalter, and H. J. Porter, vice-presidents, and J. F. Strough, secretary-treasurer. Mr. Spray is also general sales manager of the company. Mr. Lothrop started with the Timken company in 1911 as metallurgist, and for the past eighteen years has been intimately connected with its affairs, being closely associated with H. H. Timken. During that time, he has occupied various capacities successively in metallurgy, research, in charge of operations, and, for the last few years, as vice-president and general manager in charge of all operations and sales.

THEODORE FRIEDEBERG, president of the Manhattan Machinery Exchange, New York, N. Y., has acquired the plant, machinery and real estate of the McMyler Interstate Co., of Cleveland. Mr. Friedeberg, whose business is the purchase, sale and liquidation of large industrial plants, expects to continue the business of the company as at present, which is the manufacture of cranes and similar equipment.

NEIL C. HURLEY, formerly head of the Hurley Machine Co., and J. F. Roche, formerly vice-president of the Apex Electric Distributing Co., are now respectively president and executive vice-president of the reorganized Binks Manufacturing Co., of Chicago. This company, which manufactures spray painting equipment and spray cooling systems, was formerly known as the Binks Spray Equipment Company.

LOUIS E. MURPHY has been elected president of E. F. Houghton & Co., Philadelphia, to succeed the late Chas. E. Carpenter, who died on April 6. A. E. CARPENTER was elected first vice-president and treasurer, and GEORGE W. PRESSELL was elected second vice-president and secretary. The Houghton company manufactures oils and leathers for the industries, and has plants in Philadelphia, Chicago and Detroit.

ALEXANDER TAYLOR, who is vice-president of the Lake Superior Corporation as well as secretary of the Algoma Steel Corporation and other subsidiaries, has been appointed acting president of the Lake Superior firm as a result of the resignation of Robert Dodd. Mr. Taylor has been identified for a number of years with the enterprises at Sault Ste. Marie.

L. A. ROWLAND has been selected for the newly created post of works manager at the John Deere Tractor Works, Waterloo, Iowa, Allen H. Head, general manager of the plant, announced last week. Mr. Rowland came to Waterloo from the John Deere Plow Works, Moline, Ill., with which he was associated 18 years, the last 10 years being superintendent. FRANK M. HUMASON, his assistant in the Plow works, has succeeded him as superintendent and L. A. Murphy has been advanced to assistant superintendent.

FRANK GODFREY BURCH, who for the past twelve years has been on the sales staff of the Canadian Ingersoll-Rand Co., Ltd., was recently appointed assistant manager of the company's Montreal sales branch.

LEONARD S. HORNER, president, Niles-Bement-Pond Co., New York City, has been elected a member of the board of directors of the Chamber of Commerce of the United States for the first election district.

R. F. ARTHUR, formerly in charge of the Chicago office of the Dravo Equipment Co., has been appointed manager of the Midwestern branch office recently opened by the Aeroil Burner Co., of West New York, N. J. His headquarters are at 176 North Wacker Drive, Chicago.

Obituaries

JOSEPH N. LAPOINTE, 68, founder of the J. N. Lapointe Co., and one of the country's pioneer manufacturers of broaching machines, died in New London, Conn., on May 4 of heart disease. He was born in a suburb of Montreal, Canada, and moved to Waterbury, Conn., at the age of 17. His first job was at the Benedict Brass Manufacturing plant at Waterbury as an apprentice. He next went with the Waterbury Watch Co., where he remained for seven years. Later he spent some time with the Seth Thomas Clock Co., and after going in business for himself, finally came to the Pratt & Whitney Co. in Hartford, where he was in charge of experimental work for fourteen years. At the Pratt & Whitney plant he devised a broaching system now in general use. From the Pratt & Whitney Co., Mr. Lapointe went to the Becker Milling Machine Co., at Hyde Park, Mass. Three years later he left that company to engage in business for himself at Boston, where he perfected a broaching machine of his own design. In 1906 he built a plant at Hudson, Mass., known as the Lapointe Machine Tool Co. He severed his connection with the company in 1911 and organized the J. N. Lapointe Co. in Marlboro, Mass., to manufacture broaching machines. In 1913 the company moved to New London where Mr. Lapointe operated it until 1919, when he sold out and bought the Arnold Electric Tool Co. of New London. In recent years Mr. Lapointe has not been active in the machine tool industry, but has largely been interested in real estate operations.

L. GLEN HEWINS, sales manager of Gears and Forgings, Inc., Cleveland, Ohio, was killed with his wife on May 8, when the automobile is which he was riding was struck by a train at Newcastle, Ind. He was 41 years old and had been associated with the company and one of its predecessors for 14 years. He was a graduate of Dennison University, Granville, Ohio. One of his chief interests had been industrial marketing.

WILLIAM GAMBLE, aged 69, who up until his retirement 5 years ago was purchasing agent for the Moline (Ill.) Plow Co., now the Moline Implement Co., died April 29 in his home in Moline. He had retired from active business five years ago. For seven years prior to his retirement he was at the Poughkeepsie (N. Y.) factory.

GEORGE R. LOMBARD, pioneer machinery manufacturer of the Southeast, died recently at his home in Augusta, Ga., following a long illness. At the time of his death Mr. Lombard was the president of the Lombard Iron Works & Supply Co., of Augusta, which he founded many years ago. The company manufactured engines, pumps, boilers and similar equipment, and operated one of the largest plants of this kind in the South. Mr. Lombard was a charter member of the Southern Metal Trades Association and has always been active in its affairs. He was about 75 years of age.

Forthcoming Meetings

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Third national meeting of the aeronautic division, St. Louis, Mo., May 27-30. Semi-annual meeting, Salt Lake City, Utah, July 1-4. Third national meeting of the Iron and Steel Division, during the Steel Treaters' Exposition, Cleveland, September 11-13. Calvin W. Rice, secretary, 29 West 39th St., New York City.

AMERICAN GEAR MANUFACTURERS' ASSOCIATION. Thirteenth annual meeting to be held in the Hotel Statler, Cleveland, Ohio, May 16-18. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland.

NATIONAL ASSOCIATION OF PURCHASING AGENTS. Annual meeting, June 3-6, at Buffalo. G. A. Renard, secretary, 11 Park Place, New York.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting, June 24-28, at the Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

SOCIETY OF AUTOMOTIVE ENGINEERS. Summer meeting, Saranac Inn, Upper Saranac Lake, N. Y., June 25-28. Coker F. Clarkson, manager, 29 E. 39th St., New York.

NATIONAL METAL CONGRESS. To be held in Cleveland September 9 to 13. Simultaneous meetings of the American Welding Society, the Institute of Metals Division of the American Mining & Metallurgical Engineers, the Iron & Steel Division, American Society of Mechanical Engineers, the Iron & Steel Division, A.I.M.E., and the American Society for Steel Treating. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

NATIONAL METAL EXPOSITION. Eleventh annual, held under the auspices of the American Society for Steel Treating, Cleveland Public Auditorium, Cleveland, Sept. 9-14. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

MACHINE TOOL BUILDERS EXPOSITION. Under the auspices of the National Machine Tool Builders Association, Sept. 30 to Oct. 4, in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 826 Provident Bank Bldg., Cincinnnati.

THE WEEKLY PRICE GUIDE . . .

Rise and Fall of the Market

EMI-FINISHED steel continues scarce with prices firm in finished materials. Shapes and plates are $1.95 per 100 lb., Pittsburgh, unchanged from levels of a month ago, while at the same time, this price is 10c. per 100 lb. higher than that obtained in May, 1928. Black and galvanized sheets are up 25c. per 100 lb. at Chicago warehouses, this week. The principal declines of the week were as follows: tin, 1c. per lb. (47c.) at New York; lead, 0.025c. per lb. (6.8c.) at East St. Louis; solder, ¼c. per lb. (32¼c.) at New York; babbitt metal, highest grade, 1c. per lb. (61c.) at New York. Slab zinc is up 0.05c. per lb. (6.65c.) at East St. Louis, while higher prices are being paid for scrap brass and copper in the New York market.

(All prices as of May 10, 1929)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b:

CINCINNATI	
No. 2 Southern (silicon 1.75@2.25)	$18.94
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 1.75@2.25)	24.50
BIRMINGHAM	
No. 2 Foundry (silicon 1.75@2.25)	15.50
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.76)	21.76
Virginia No. 2	27.17
Basic	20.76
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 1.75@2.25)	21.26
PITTSBURGH, including freight charge ($1.76) from Valley:	
No. 2 Foundry	19.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb:

Detroit	4.50
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots:

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.20	3.35	3.25	3.90*
No. 12	2.25	3.40	3.30	3.95*
No. 14	2.35	3.45	3.35	4.00*
No. 16	2.45	3.55	3.45	4.10*
Black				
Nos. 18 to 20	2.75	3.85	3.70	3.80
No. 22	2.90	4.00	3.85	3.95
No. 24	2.95	4.05	3.90	4.00
No. 26	3.05	4.15	4.00	4.10
No. 28	3.20	4.75	4.15	4.25
Galvanized				
No. 10	2.90	4.20	4.05	4.05
Nos. 12 to 14	3.00	4.30	4.15	4.15
No. 16	3.10	4.40	4.25	4.25
No. 18	3.25	4.55	4.40	4.40
No. 20	3.40	4.70	4.60	4.55
No. 22	3.45	4.75	4.65	4.60
No. 24	3.70	4.90	4.75	4.75
No. 26	3.85	5.15	5.00	5.00
No. 28	4.10	5.40	5.25	5.25

*Up to 3,999 lb.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in., butt welded	50%	36%	55½%	43½%	54%	41%
2½ to 6 in., lap welded	45%	32%	53½%	40½%	51%	38%

WROUGHT-STEEL PIPE LIST

Size, Inches	List Price per Foot	Diameter in Inches—External	Diameter in Inches—Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb:

Thickness—Decimal Fractions	B.w.g. and	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.25†	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10†	5.30	5.00
Cold drawn, round or hexagon‡	3.50	3.65	3.60
Cold drawn, flat or square‡	4.00	4.15	4.10
Structural shapes	3.30†	3.00	3.10
Soft steel bars	3.25†	3.00	3.00
Soft steel bar shapes	3.25†	3.00	3.00
Soft steel bands	3.75†	3.65	3.65
Tank plates	3.30†	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$-in. thick. †Up to 3,999 lb., ordered and released for shipment at one time. ‡Cold finished steel, shafting and screw stock.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$, 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			19.25
Tin, Straits, pigs, New York			47.00
Lead, pigs, E. St. Louis	6.80	New York	8.00
Zinc, slabs, E. St. Louis	6.65	New York	8.50

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.50	14.25
Copper sheets, base	27.75	27.75	27.75
Copper wire, base	19.87½	20.25	19.87½*
Copper bars, base	26.25	26.25	26.25
Copper tubing, base	29.25	29.25	29.25
Brass sheets, high, base	23.25	23.25	23.25
Brass tubing, high, base	28.25	28.25	28.25
Brass rods, high, base	21.25	21.25	21.25
Brass wire, high, base	23.75	23.75	23.75

*At mill.

SHOP MATERIALS AND SUPPLIES

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%.....	25.00*	24.30	24.30
Zinc sheets (casks).....	10.50@11.00	11.70	10.11
Solder (½ and ½).....	32.25	32.75	31@34
Babbitt metal, delivered in case lots, New York, cents per lb:			
Genuine, highest grade.....			61.00
Commercial genuine, intermediate grade.....			45.00
Anti-friction metal, general service.....			31.50
No. 4 babbitt.....			12.00

*Delivered.

NICKEL AND MONEL METAL—Price in cents per lb., base, f.o.b. Huntington, W. Va:

	Nickel	Monel Metal
Sheets, full finished.....	52.00	42.00
Sheets, cold rolled.....	60.00	50.00
Strip, cold rolled.....	55.00	45.00
Rods, hot rolled.....	45.00	35.00
Rods, cold rolled.....	53.00	40.00†
Tubing.....	75.00*	90.00
Angles, hot rolled.....	50.00	40.00
Plates.....	52.00	42.00

*Seamless. †Cold drawn.

OLD METALS—Dealers' purchasing prices in cents per pound, f.o.b. cars, depending on quantity offered for sale:

	New York	Cleveland	Chicago
Crucible copper.....	14.50 @14.75	13.50	13.00 @14.00
Copper, heavy, and wire..	13.25 @14.50	13.00	12.00 @13.00
Copper, light, and bottoms	12.00 @12.50	12.50	11.00 @12.00
Heavy lead.....	5.25 @ 5.50	6.25	5.00 @ 5.50
Tea lead.....	3.75 @ 4.25	4.25	4.00 @ 4.50
Brass, heavy, yellow.....	8.00 @ 8.50	8.00	8.00 @ 8.50
Brass, heavy, red.....	.....	12.50	12.00 @12.50
Brass, light.....	7.00 @ 7.50	7.50	8.00 @ 8.50
No. 1 yellow rod turnings.	9.00 @ 9.50	9.00	10.00 @10.50
Zinc.....	3.25 @ 3.50	3.25	3.00 @ 3.25

TIN PLATES—Charcoal—Bright—Per box:

	New York	Cleveland	Chicago
"AAA" Grade:			
IC, 14x20.....	$12.10	$11.95	$11.50
"A" Grade:			
IC, 14x20.....	9.70	9.90	9.50
Coke Plates—Primes—Per box:			
100-lb., 14x20.....	6.45	6.10	7.00
Terne Plates—8-lb. Coating—Small lots—Per box:			
IC, 14x20.....	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.*	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb.*	.09@ .13	.12	.12
Wiping cloths, washed white, per lb.†.....	.16	38.00 per M	.16
Sal soda, per lb.....	.02¼	.02	.02
Roll sulphur, per lb.....	.027	.03½	.04
Linseed oil, raw, in 1 to 4 bbl. lots, per lb.....	.109	.11	.113
Cutting oil, about 25% lard, in 5 gal. cans, per gal.....	55	.60	.65
Machine oil, medium-bodied (55 gal. steel bbl.) per gal..	.33	.36	.35
Belting — Present discounts from list in fair quantities (½ doz. rolls) for leather or rubber:			
Leather—List price, 24c. per lin. ft., per inch of width, for single ply:			
Medium grade.....	30–10%	30–10%	35%
Med. grade, heavy wgt...	30– 5%	30– 5%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft:			
First grade.....	50%	50–10%	50%
Second grade.....	60%	60– 5%	50–10%

*All waste in bale lots. †100-lb. bales.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars.....	per lb..	$0.0325	$0.0325	$0.0325
Cold drawn shafting...	per lb..	.035	.035	.034
Brass rods.....	per lb..	.2125	.2487½	.165
Solder (½ and ½).....	per lb..	.3225	.35	.335
Cotton waste, white...	per lb..	.10@.13½	.10@.13½	.10@.13½
Disks, aluminum oxide mineral, cloth, No. 1, 6-in. dia.....	per 100.	3.60	3.60	3.10
Lard cutting oil.....	per gal.	.55	.55	.65
Machine oil.....	per gal.	.33	.33	.30
Belting, leather, medium.....	off list..	30–10%	30–10%	35%
Machine bolts, up to 1x30 in., full kegs...	off list..	50-10%*	50–10%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials — Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
Flint paper.....	$4.50	$4.29	$4.29
Emery cloth.....	22.93	20.97	20.97
Disks, aluminum oxide mineral, 6 in. dia., No. 1, per 100:			
Paper.....	2.64	2.04	2.04
Cloth.....	3.60	3.59	3.59
Fire clay, per 100 lb. bag.....	1.00	.75	.75
Coke, prompt furnace, per net ton...	Connellsville, 2.75@2.85		
Coke, prompt foundry, per net ton...	Connellsville, 3.75@4.50		
White lead, dry or in oil...	100 lb. kegs....	New York, 13.75	
Red lead, dry.....	100 lb. kegs....	New York, 13.75	
Red lead, in oil.....	100 lb. kegs....	New York, 15.25	

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

Machine bolts:	
Up to ¾-in. x 6-in., full kegs, list less.....	60%
Larger, up to 1 x 30-in., full kegs, list less.....	50–10%
Less than full kegs or case lots, add to list.....	10%
Fitting-up bolts: list less.....	45%
Lag screws:	
Up to ½-in. x 6-in., list less.....	60%
Larger, list less.....	50–10%
Less than full keg or case lots, add to list.....	10%
Rivets:	
Structural, round head, full kegs, net.....	$4.50
Structural, round head, broken kegs, net.....	6.00
Tank, 7–16-in. dia. and smaller, list less.....	60%
Nuts:	
Hot pressed, square or hexagonal, blank or tapped:	
Full kegs up to 1-in., incl., list less.....	60%
Larger, up to 3-in., list less.....	40–10%
Less than keg or case lots, add to list.....	10%
Washers:	
Wrought, full kegs, per 100 lb., list less.....	$4.00
Wrought, broken kegs, per 100 lb., list less.....	2.00
Turnbuckles:	
With stub ends, list less.....	20%
Without stub ends, list less.....	50%
Chain:	
Proof coil, base, per 100 lb., net.....	$7.10
Cast iron welding flux, per lb., net.....	.40
Brazing flux, per lb., net.....	.80

MACHINE REQUIREMENTS AND INDUSTRIAL CONSTRUCTION

Equipment Wanted

Calif., Vallejo—Bd. of Education, E. L. Cave, Secy.—will receive bids until May 28, for tools, equipment and machinery for proposed vocational shop of senior high school.

Md., Baltimore—Baltimore Spring Bed Co., 754 West Pratt St.—machinery and equipment for proposed addition to plant.

Mass., Cambridge (Boston P. O.) — P. O. Box 22—circular saw rigged with conveyor for sawing logs.

Mich., Detroit — Frederick Colman & Sons, 7250 Central Ave.—machine shop equipment for proposed expansion.

Mich., Detroit—Federal Screw Works, 3401 Martin Ave.—machinery and equipment for the manufacture of screw products for proposed 1 story, 70 x 400 ft. screw products factory. Estimated cost $55,000.

Mich., Detroit—Ternstedt Mfg. Co., 6307 West Fort St.—miscellaneous machine shop equipment for proposed 2 story, 125 x 134 ft. automobile accessory factory on Crawford St. Estimated cost $40,000.

N. Y., Albany—New York State College for Teachers, C. J. Deyo, Treas.—will receive bids until May 22, for industrial shop equipment, etc.

Tex., San Antonio—Packard Motor Co., 300 Broadway, Lessee—machinery and equipment for general auto repairing for proposed 1 story, 111 x 168 ft. garage and sales and service building at Main and Poplar Sts. R. Thompson, Texas Theatre Bldg., Owner.

Tex., San Antonio—Texas Co., W. Travis St. machinery and equipment for general motor repairing for proposed 30 x 200 ft. garage at Probandt St. Estimated cost $110,000.

N. B., Sackville—Enterprize Foundry Co., Ltd. machinery and equipment (soon) for enameling plant.

Ont., Toronto—Hector McLean, 3240 Tonga St.—is receiving bids for machinery and equipment for proposed 2 story, 60 x 150 ft. garage and service station.

Opportunities for Future Business

Ala., Gadsden—Gulf States Steel Co., W. Y. Coverdale, Pres., B.-M. Bldg., Birmingham, awarded contract for the construction of an electrically driven blooming mill here. Estimated cost $1,000,000.

Calif., Los Angeles—West Coast Casket Co., 1495 East 4th St., is having plans prepared for a 1 story, 87 x 250 ft. factory on Hooper St. F. D. Harrington, H. W. Hellman Bldg., Archt.

Calif., San Francisco—Fifty Vara Improvement Assn., c/o E. H. Denke, 1315 Hyde St., Archt., is having plans prepared for a garage at Sutter and Stockton Sts. Estimated cost to exceed $150,000.

Conn., Bridgeport—City Lumber Co., I. E. Schine, Pres., Seaview and Charlotte Sts., is having plans prepared for the construction of a planing mill. Estimated cost $40,000. F. B. Jaynes, 77 Plaza St., Archt. Noted Apr. 4.

Conn., Fairfield—H. A. Seymoure Co., H. A. Seymoure, Pres., manufacturers of metal novelties, plans a 1 story, 40 x 200 ft. factory on Post Rd. Estimated cost $45,000. Private plans.

Conn., Hartford—L. F. Dettenborn Woodworking Co., Taylor St., had plans prepared for a 4 story, 40 x 200 ft. woodworking plant. Estimated cost $100,000.

Conn., Hartford — Skayef Ball Bearing Co., 330 New Park Ave., plans the construction of a 1 story, 75 x 150 ft. plant. Estimated cost $80,000. Architect not selected.

Conn., Stamford — Kings County Foundry, Fairfield Ave., had plans prepared for a 2 story, 50 x 100 ft. foundry. Estimated cost $50,000. Private plans.

Fla., Palatka—Wilson Cypress Co., plans rebuilding saw mill recently destroyed by fire.

Ill., Chicago—A. L. Hansen Mfg. Co., 5037 Ravenswood Ave., manufacturers of automotive hardware, awarded contract for a 3 story addition to factory. Estimated cost $30,000.

Ill., Chicago—Hanna Engineering Co., 1757 Elston Ave., manufacturers of air hoists and riveters, awarded contract for a 1 story, 45 x 288 ft. addition to plant. Estimated cost $35,000.

Ill., Cicero — Empire Metal Products Co., 5443 West Roosevelt Rd., awarded contract for a 1 story, 120 x 180 ft. plant. Estimated cost $60,000. Noted May 2.

Ill., Cicero—Scott Bansbach Machinery Co., 130 South Clinton St., Chicago, awarded contract for a 1 story, 75 x 125 ft. at 20th St. and 47th Ave. here. Estimated cost $30,000.

Ill., Joliet — E. Corlett, Scott St., awarded contract for a 1 story 132 x 165 ft. garage, etc. at Scott and Van Buren Sts. Estimated cost $175,000.

Ind., Indianapolis—Plaza Oil Co., 121 East Maryland St., awarded contract for a 135 x 165 ft. machine shop and garage. Estimated cost $60,000. Vonnegust-Bohn & Mueller, Indiana Trust Bldg., Archts.

Ind., Jasper—Jasper Chair Co., awarded contract for a 2 story, 297 x 457 ft. factory. Estimated cost $125,000.

Ind., Jasper — New Indiana Chair Co., will soon award contract for a 1 and 2 story, 290 x 300 ft. chair factory on Vine St. Estimated cost $100,000. E. C. Berendes, McCurdy Bldg., Evansville, Archt. Noted Apr. 25.

Ia., Carroll—Saul Aircraft Corp., c/o W. I. Saul, is having preliminary plans prepared for an airplane factory. Estimated cost $125,000.

Kan., Kansas City—Kansas City Structural Steel Co., 21st St. and Metropolitan Ave., will build addition to plant. Estimated cost $50,000. Private plans.

Md., Baltimore—Atlantic Southwestern Broom Co., 1300 South Baylis St., will build a 60 x 94 ft. addition to plant. Estimated cost $25,000.

Md., Baltimore — Enterprise Wire & Iron Works, G. W. Wilkinson, Pres., 423 North High St., will build a 1 story, 35 x 86 ft. addition to plant.

Md., Baltimore — Rustless Iron Corp. of America, A. H. Wild, Pres., Loney's Lane and Pennsylvania R.R., will build a 1 story addition to mill for the manufacture of rustless and corrosion resisting alloys, sheet bars, etc.

Mass., Everett (Boston P. O.)—H. K. Porter, Inc., 6 Ashland Ave., (cutters) is receiving bids for a 1 story, 80 x 125 ft. factory on Ashland Ave. Estimated cost $50,000. J. R. Worcester, 79 Milk St., Boston, Archt. Noted Apr. 18.

Mass., Walpole — Hollingsworth & Voe Co., 333 Washington St., Boston, is having preliminary plans prepared for a 1 story, 35 x 225 ft. machine shop, also paper manufacturing building. C. Eldrid, c/o owner, engr.

Mich., Detroit—Clayton Lambert Co., French Rd., manufacturers of brass accessories, awarded contract for a 1 story, 100 x 100 ft. factory. Estimated cost $40,000.

Mich., Pontiac — Oakland Motor Car Co. awarded contract for a 1 story, 120 x 455 ft. addition to automobile plant. Estimated cost $130,000.

Mo., Bridgeton — Curtiss-Robertson Airplane Mfg. Co., c/o W. R. Robertson, is having preliminary plans prepared for a 1 and 2 story addition to airplane factory at Lambert-St. Louis Flying Field. Estimated cost $300,000.

Mo., Marshall — Nicholas-Beazley Airplane Co., Inc., R. Nicholas, Pres., English and North Sts., awarded contract for a 1 story, 50 x 155 ft. addition to airplane factory. Estimated cost $40,000. Noted Mar. 14.

N. J., Newark — Packard Motor Car Co., Broadway and 61st St., New York, N. Y., is having plans prepared for a 3 story, 200 x 245 ft. factory at Central Ave. from 16th to 17th Sts. Estimated cost $300,000. A. Kahn, 1004 Marquette Bldg., Detroit, Mich., is architect.

N. J., Newark—F. A. Phelps, 21 Fulton St., Archt., is receiving bids for a 2 story, 40 x 125 ft. addition to plant at Oliver St. and New Jersey Railroad Ave. for American Platinum Works, 231 New Jersey Railroad Ave. Esti-

N. J., Newark — White Co., East 79th St., Cleveland, O., is having plans prepared for a 1 story, 100 x 270 ft. service station at 448-50 Mulberry St. here. Estimated cost $150,-000. Private plans.

N. J., Perth Amboy—Raritan Copper Works, Elm St., will build three 1 story additions to plant. Estimated cost $55,000. Noted Apr. 25.

N. J., Plainfield — Owner, c/o A. M. Korff, 203 Park Ave., is having plans prepared for a 1 story garage on South Ave. between Scott Ave. and Berkman St. Estimated cost $150,000.

N. Y., Brooklyn—E. A. Wildermuth, 1057 Atlantic Ave., plans a 3 story, 110 x 200 ft. garage at Atlantic and Franklin Aves. Estimated cost $150,000. Slee & Bryson, 160 Montague St., archts.

N. Y., Brooklyn — G. H. Zeiner, Crown St. and Bedford Ave., plans a 2 story, 100 x 131 ft. garage. Estimated cost $75,000. G. E. Beatty, 916 St. Marks Ave., Archt. Maturity August. Noted Apr. 18.

N. Y., Long Island City—National Casket Co., 470 Jackson Ave., plans a 5 story, 60 x 232 ft. factory at Jackson and 41st Aves. Estimated cost $200,000. Stein & Vitolo, 56 West 45th St., New York, Archt.

N. Y., Long Island City — Three Hundred Forty West 57th St. Corp., 242 West 76th St., plans a 2 story, 100 x 140 ft. garage at Queens Blvd. and 87th Ave. Estimated cost $150,000. B. Braunstein, 163-18 Jamaica Ave., Archt.

N. Y., New York—Bisroe Realty Corp., N. S. Rebhun, Pres., 391 East 149th St., will build a garage at Story and Manor Aves. Estimated cost $75,000. L. Stillman, 2419 Webster Ave., Archt.

N. Y., New York — C. L. Peillon, 125 East 70th St., plans the construction of a 2 story, 98 x 100 ft. garage and repair shop at 542 West 26th St. Estimated cost $75,000. F. S. Parker, 119 West 57th St., Archt.

N. Y., New York—J. Sternberg, 1116 Ave. H., Brooklyn, plans a 5 story, 40 x 103 ft. garage at 131 East 12th St. here. Estimated cost $75,000. Garnava & Viviani, 690 8th Ave., Archts.

N. Y., Poughkeepsie—De Laval Separator Co., ft. Pine St., will soon award contract for the construction of a foundry. S. H. Chadwick, 140 Cedar St., Archt.

N. Y., St. George (sta. Staten Island)—Merritt, Chapman & Scott, 135 Edgewater St., had plans prepared for the construction of machine and carpenter shops at Edgewater St. and Maple Ave. Estimated cost $85,000. Baker & Spencer, 17 Battery Pl., New York, Archts.

N. Y., Utica—White Motor Co., G. H. Kelly, Treas., East 79th St. and St. Clair Ave., Cleveland, O., awarded contract for a 1 story sales and service building. Estimated cost $150,000.

O., Canton — Timken Roller Bearing Co., Dauber Ave., plans the construction of a 1 story, 100 x 800 ft. factory. Estimated cost $100,000. Private plans.

O., Cleveland—Atlas Steel & Supply Co., 4401 Trumbull Ave., awarded contract for a 1 story, 50 x 250 ft. factory. Estimated cost $50,000. Noted Apr. 18.

O., Cleveland—Cleveland Union Terminal Co., C. L. Bradley, Pres., Terminal Tower, will soon award contract for the construction of a 39 x 198 ft. inspection shed and two 108 x 304 ft. motor repair shops at Cinndale and Collinwood yards. Estimated cost $150,000. A. F. Falvey, Terminal Tower, Archt.

O., Cleveland—Gravity Carburetor Co., 3062 East 3rd St., had plans prepared for a 1 story, 40 x 100 ft. addition to factory. Estimated cost $40,000. Best & Hoefler, 4500 Euclid Ave., Archts.

Pa., Pittsburgh—Heppenstall Forge & Knife Co., 4620 Hatfield St., awarded contract for a 1 story, 41 x 120 and 18 x 90 ft. addition to factory. Estimated cost $40,000. Noted May 2.

Pa., Washington — Washington Mould Machine & Foundry Co. awarded contract for a 1, 2 and 3 story foundry on West Beau St. Estimated cost $40,000. Noted May 2.

Tex., Austin—University of Texas, c/o Bd. of Regents, is having plans prepared for the construction of a 1 story shop building on University campus. Estimated cost $175,000. H. M. Greene, La Roche & Dahl, 307 Construction Industrial Bldg., Dallas, Archt.

Man., Winnipegasis—Standard Lumber Co. of Manitoba Ltd., sash and door manufacturers, plans addition to plant. Estimated cost $50,000.

Ont., Fergus—Beatty Bros., manufacturers of washing machines, etc., awarded contract for three 1 story additions to factory, 48 x 150, 96 x 336 and 72 x 96 ft. Estimated cost $150,000.

Ont., Walkerville—Stout All Metal Airplane Co., Poss Depot, Ford Airport, Detroit, plans the construction of a plant here. Estimated cost $1,000,000.